Notice No.2

Rules and Regulations for the Classification of Offshore Units July 2016

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Please note that corrigenda amends to paragraphs, Tables and Figures are not shown in their entirety.

Issue date: June 2017

Amendments to	Effective date
Part 1, Chapter 2, List of abbreviations, Sections 1, 2 & 3	1 July 2017
Part 1, Chapter 3, Sections 2, 3, Appendix 1 & Appendix 2	1 July 2017
Part 3, Chapter 1, Section 7	1 July 2017
Part 3, Chapter 2, Section 2	1 July 2017
Part 3, Chapter 3, Section 2	1 July 2017
Part 3, Chapter 4, Sections 1 & 2	1 July 2017
Part 3, Chapter 9, Section 8	1 July 2017
Part 3, Chapter 10, Sections 4, 6, 8, 10 & 13	1 July 2017
Part 3, Chapter 13, Sections 1, 3, 6, 10 & 11	1 July 2017
Part 3, Chapter 15, Section 1	1 July 2017
Part 3, Chapter 16, Section 2	1 July 2017
Part 3, Chapter 17, Sections 1 to 6	1 July 2017
Part 3, Appendix A, Sections 1 & 21	1 July 2017
Part 4, Chapter 1, Section 4	1 July 2017
Part 4, Chapter 2, Section 2	1 July 2017
Part 4, Chapter 3, Section 7	1 July 2017
Part 4, Chapter 4, Sections 1 & 4	1 July 2017
Part 4, Chapter 5, Section 5	1 July 2017
Part 4, Chapter 6, Sections 1, 4 & 7	1 July 2017
Part 4, Chapter 8, Section 6	1 July 2017
Part 5, Chapter 12, Sections 1 & 2	1 July 2017

Part 5, Chapter 24, Sections 1 to 6	1 July 2017
Part 6, Chapter 1, Sections 1, 2 & 6	1 July 2017
Part 6, Chapter 2, Sections 1, 2 & 3	1 July 2017
Part 7, Chapter 1, Sections 1, 3 & 6	1 July 2017
Part 7, Chapter 2, Sections 1 & 6	1 July 2017
Part 7, Chapter 3, Section 3	1 July 2017
Part 8, Chapter 1, Section 1	1 July 2017
Pt 10, Chapter 3, Section 1	1 July 2017
Part 11, Chapter 5, Sections 4 & 5	Corrigenda
Part 11, Chapter 13, Section 1	Corrigendum
Part 12, Chapter 1, Sections 1 to 38	1 July 2017

Part 1, Chapter 2
Classification Regulations

■ List of abbreviations

(*Part only shown*)

FLNG	Floating LNG
FMEA	Failure Modes and Effects Analysis
FPSO	Floating Production, Storage and Off-loading installation

■ *Section 1*
Conditions for classification

1.1 Application

(Part only shown)

1.1.2 An offshore unit may be assigned one of the two following class notations:

OI

This notation is applicable to floating offshore installations that operate at a fixed geographic location for their entire service life, ~~see~~ *see* ~~1.2~~ *Pt 1, Ch 2, 1.2 Floating offshore installations at a fixed location*.

The following asset types are covered by the **OI** notation:

- buoys~~.~~;
- floating offshore sea-water desalination units.

OU

This notation is applicable to mobile offshore units that operate at and transit between different locations, ~~see~~ *see* ~~1.3~~ *Pt 1, Ch 2, 1.3 Mobile offshore units*.

The following asset types are covered by the **OU** notation:

- column-stabilised semi-submersible units (mobile offshore drilling units, heavy lift vessels, pipe-laying units, accommodation units and diving support vessels);
- self-elevating (jack-up) mobile offshore drilling units;
- surface type units (drill ships, twin-hull heavy lift vessels and pipe-laying units);
- wind turbine installation vessels;
- tender barge.

1.4 General

1.4.10 ~~For units, the arrangements and equipment of which are required to comply with the requirements of the:~~ The Classification Committee requires that units comply with all requirements of the National Administration and all applicable mandatory international IMO and ILO Conventions and Codes (including Amendments thereto), including the following:

- ~~*2009 MODU Code - Code for the Construction and Equipment of Mobile Offshore Drilling Units, 2009 – Resolution A. 1023(26)* (2009 MODU Code);~~
- ~~*Load Lines Convention*;~~
- ~~*SOLAS - International Convention for the Safety of Life at Sea* and its Protocol of 1978;~~
- ~~*Articles of the International Convention for the Prevention of Pollution from Ships, 1973,* as modified by the Protocol of 1978 relating thereto;~~
- ~~*IBC Code - International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in BulkAmended*~~
- ~~*by Resolution MEPC.225(64);* and applicable Amendments thereto.~~
- *Load Lines, 1966/1988 - International Convention on Load Lines, 1966, as Amended by the Protocol of 1988*
- *SOLAS - International Convention for the Safety of Life at Sea*
- *MODU – Code for the Construction and Equipment of Mobile Offshore Drilling Units*
- *MARPOL - International Convention for the Prevention of Pollution from Ships*
- *AFS - International Convention on the Control of Harmful Anti-Fouling Systems on Ships, 2001*
- *Tonnage - International Convention on Tonnage Measurement of Ships, 1969*
- *IBC Code - International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk Amended by Resolution MEPC.225(64)*
- *2014 IGC Code - International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk*
- *IMSBC Code – International Maritime Solid Bulk Cargoes Code – Resolution MSC.268(85)*
- *Maritime Labour Convention.*

~~The Classification Committee requires the applicable Convention Certificates to be issued by a National Administration, or by LR, or by an IACS Member when so authorised. Safety Management Certificates in accordance with the provisions of the*International Safety Management (ISM) Code – Resolution A.741(18)* may be issued by an organisation complying with *IMO Resolution A. 739(18) – Guidelines for the Authorization of Organizations Acting on Behalf of the Administration – (Adopted on 4 November 1993)Amended by Resolution MSC.208(81)* and authorised by the National Administration with which the unit is registered. Cargo Ship Radio Certificates~~

~~may be issued by an organisation authorised by the National Administration with which the unit is registered. In the case of dual classed units, Convention Certificates may be issued by the other Society with which the unit is classed, provided that this is recognised in a formal Dual Class Agreement with LR and provided that the other Society is also authorised by the National Administration. In the event of a National Administration withdrawing any unit's Convention Certificate (referred to in this Section), then the Classification Committee may suspend the unit's class. If a unit is removed from the National Administration's Registry for non-compliance with the Conventions or Classification requirements referred to herein then the Classification Committee will suspend the unit's class. In the event of ISM Code certification being withdrawn from a unit or Operator, the Classification Committee will suspend the unit's class.~~

The Classification Committee requires the applicable Convention and Code Certificates to be issued by authorities as follows:

- Cargo Ship Radio Certificates, Safety Management Certificates, International Ship Security Certificates and Maritime Labour Certificates, if required, must have been issued by a recognised organisation authorised by the National Administration with which the unit is registered.
- All other mandatory statutory certificates must have been issued by LR or by a National Administration or by an IACS Member when so authorised by the National Administration with which the unit is registered.

In the case of dual-classed units, Convention Certificates may be issued by the other Classification Society with which the unit is classed, provided this is recognised in a formal Dual Class Agreement with LR and provided the other Classification Society is also authorised by the National Administration.

In the event of a National Administration withdrawing any unit's Convention Certificate (referred to in this Section), then the Classification Committee may suspend the unit's class. If a unit is removed from the National Administration's Registry for the non-compliance with the Conventions or Classification Requirements referred to herein, then the Classification Committee will suspend the unit's class. In the event of ISM Code certification being withdrawn from a unit or Operator, then the Classification Committee will suspend the unit's class.

■ *Section 2*
Definitions, character of classification and class notations

2.3 Character Symbols

(*Part only shown*)

2.3.2

Note For classification purposes, the character figure **1**, and either of the character letters **T** or **N**, is to be assigned.

2.4 Class notations (hull/structure)

(*Part only shown*)

2.4.13 The following special features class notations may be assigned as considered appropriate by the Classification Committee:

OIWS This notation for In-Water Survey may be assigned to a unit where the applicable requirements of LR's Rules and Regulations are complied with, ~~see~~ *see Pt 1, Ch 3, 4.3 In-water surveys*, *Pt 3, Ch 1, 2.1 General* and *Pt 8, Ch 1, 1.3 External zone protection. protection*.

PLS This notation will be assigned to mobile offshore units which are fitted with LR-classed pipe-laying equipment. The pipe-laying equipment is to be constructed, installed and tested under LR's Special Survey and in accordance with LR's *Code for Lifting Appliances in a Marine Environment, July 2016, incorporating Notice No. 1&2* (as applicable), *see Pt 3, Ch 17 Pipe-laying Units*.

2.5 Class notations (machinery)

(*Part only shown*)

2.5.1 The following class notations are associated with machinery construction and arrangements, and may be assigned as considered appropriate by the Classification Committee:

IGS This notation will be assigned, when a unit having facilities for the storage of crude oil in bulk is fitted with an approved system for producing gas for inerting the crude oil storage tanks.

CAC1, 2 or **3** Crew Accommodation Comfort. This notation may be assigned to units which have crew accommodation and work areas compliant with standards for noise and vibration levels defined in the *Rules and Regulations for the Classification of Ships incorporating Notice Nos 1,2,3,4&5*. Following the **CAC** notation, the numeral **1**, **2** or **3** will indicate the acceptance criteria to which the noise and vibration levels have been assessed.

FWS This notation will be assigned when installed fresh water systems have been designed, constructed and tested under LR's Special Survey and in accordance with LR Rules.

LFPF (GF, NG or **EG** or **LP** or **HG** or **ML)** Low flashpoint fuel. This notation may be assigned to units where the main propelling and/or auxiliary machinery is designed to operate on a low flashpoint fuel, or a combination of low flashpoint fuel and standard marine oil fuel, in accordance with LR's *Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels*. The low flashpoint fuel (or fuels) that the unit is designed to use is (are) indicated in the notation using a two letter identifier:

- **GF** - Assigned to ships other than liquefied gas carriers or tankers, where the main propelling and/or auxiliary machinery is designed to operate on a low flashpoint fuel, or a combination of low flashpoint fuel and standard marine oil fuel. The notation also indicates that the low flashpoint fuelled machinery has been constructed, arranged, installed and tested in accordance with the LR Rules and Regulations applicable to the fuel(s) used.
- **NG** - Natural Gas
- **EG** - Ethane Gas
- **LP** - Liquid Petroleum Gas

- **HG** - Hydrogen Gas
- **ML** – Methanol

2.9 Descriptive Notes/Supplementary Character

(*Part only shown*)
2.9.1 In addition to any class notations, appropriate descriptive qualification notes may be entered on the Class Direct website indicating the type of unit in greater detail than is contained in the class notation, and/or providing additional information about the design and construction, e.g. semi-submersible. A descriptive qualification is not a LR classification notation and is provided solely for information. Examples of descriptive notes are:
SBT (LR) Segregated ballast tanks certified by LR.
Potable Water System
Sea Water Desalination Plant

■ *Section 3*
Surveys – General

3.2 New construction surveys

3.2.11 When a unit, upon completion, is transferred/towed to its operating location to be commissioned, the Classification Committee, upon application by the Owner prior to the unit being commissioned, will direct an examination to be made on site by the Surveyors. If, as a result of such survey, the structure, equipment and machinery are reported in all respects to be in accordance with applicable Rule requirements, the subsequent Special Survey and Complete Survey of the machinery will date from the time of such examination.

3.2.12 The requirements for the testing and commissioning are outlined in LR Rules. These commissioning activities should be clearly defined by the Owners and accepted by LR to ensure compliance with requirements of the Rules and any applicable statutory requirements. For instance a unit may leave the building yard with the notation **N** and after witness of the mooring will be assigned the notation **T**.

3.2.13 It is required by LR Rules that the equipment is to be tested in 'as installed' condition. Though similar tests may have been carried out during a factory acceptance test (FAT) or at the building yard, a new test in installed condition would be required. The tests shall give evidence as to satisfactory operation and performance in accordance with the Rules. When testing control systems and safety systems, failure modes shall be simulated as realistically as possible. *See also Pt 3, Appendix C Safety Critical Equipment* for details of requirements.

Existing paragraphs 3.2.11 and 3.2.12 have been renumbered 3.2.14 and 3.2.15.

3.9 Temporary suspension of class

3.9.1 When an Owner intends to move a classed unit, whether self-propelled or not, to a new operating area and, due to the unit's significant design criteria, it is not suitable for exposed sea passages outside its normal operating area, the certificate of class will automatically be suspended during sea voyages. This includes units being transported on a heavy lift vessel as a cargo. Class will be reinstated provided that the environmental criteria for the new area do not exceed the design criteria, and that an inspection by LR Surveyors when the unit arrives in the new area establishes that the hull/structure has suffered no damage in transit and remains in an efficient condition.

3.15 Life extension

3.15.1 A unit may remain in Class after the end of ~~the~~ its design life ~~of the unit~~, provided a life extension programme is approved and the appropriate surveys completed to the satisfaction of LR. Such extensions are to be for the minimum of least one Special Survey cycle.

Part 1, Chapter 3
Periodical Survey Regulations

■ *Section 2*
Annual Surveys – Hull and machinery requirements

2.8 Sea Water Desalination Plants and Fresh Water Systems

2.8.1 Offshore units having a **FWS** notation are to comply with the requirements of this sub-Section in addition to the applicable requirements of *Pt 1, Ch 3, 2.1 General*.

2.8.2 The Owner is to submit to LR a plan for cleaning, maintenance and inspection of the sea water desalination plant, if fitted, and fresh water systems for review and agreement by LR in advance of the first survey, *see Pt 1, Ch 2, 3.5 Existing installations – Periodical Surveys*. The extent of the survey is to be agreed with LR. A copy is to be kept on board and made available to the Surveyor. The planned surveys and procedures as agreed by LR will be subject to revision if found necessary at subsequent surveys or when required by the Surveyor.

2.8.3 The condition of fresh water storage tanks is to be examined.

2.8.4 Records of potable water quality are to be maintained and are to be made available to the Surveyor on request. These are to include results of analyses made by an accredited laboratory to confirm that the water quality meets that defined in the World Health Organisation's *Guidelines for Drinking Water Quality*.

2.8.5 Where sterilisation of potable water systems is carried out by means of adding chemical germicides e.g. super-chlorination or silvering, records of dosage and subsequent flushing are to be maintained and are to be made available to the Surveyor on request, *see also Pt 5, Ch 24, 3.4 Piping system distribution 3.4.8*.

2.8.6 Records of cleaning, maintenance and inspection of the sea water desalination plant, if fitted, and fresh water systems are to be maintained and are to be made available to the Surveyor on request.

■ *Section 3*
Intermediate Surveys – Hull and machinery requirements

3.2 Intermediate Surveys

3.2.2 A general examination of salt-water ballast spaces is to be carried out by the Surveyor as required by ~~*Pt 1, Ch 3, 3.2 Intermediate Surveys* and *Pt 1, Ch 3, 3.2 Intermediate Surveys*~~. *Pt 1, Ch 3, 3.2 Intermediate Surveys 3.2.3* and *Pt 1, Ch 3, 3.2 Intermediate Surveys 3.2.4*. If such examinations reveal no visible structural defects, the examination may be limited to a verification that the protective coating remains in GOOD or FAIR condition, as defined in *Pt 1, Ch 3, 1.5 Definitions*. When considered necessary by the Surveyor, thickness measurement of the structure is to be carried out.

3.2.11 When hull/structure surveys are to be carried out on the Continuous Survey basis, for all unit types over 10 years of age to comply with the intermediate survey, all salt-water ballast tanks and free-flooding areas are to be examined. The frequency of inspection all salt-water ballast tanks and free-flooding areas is to be reduced to two and half years from the customary five year period. One of the surveys in the five year cycle may be limited to an overall examination of the tank. *See also Pt 1, Ch 3, 1.6 Planned survey programme*.

Existing paragraph 3.2.11 has been renumbered 3.2.12.

■ *Appendix 1*

Notations

(*Part only shown*)

Table 3.22.1 Type Notations

Type Notations:		
Floating offshore installations: Floating Production Unit Floating Production, Storage and Offloading Unit Floating Storage Offloading Unit Sea water Desalination Unit	**Mobile offshore units:** Accommodation unit Mobile offshore drilling unit Crane unit Diving support unit Support unit Multi-purpose support unit Pipe laying unit Drill ship Fire-fighting unit 1 Fire-fighting unit 2 Fire-fighting unit 3 MainWIND Liftboat	**Buoys and single point moorings:** Mooring buoy Single-point mooring buoy Tanker loading terminal Mooring tower Articulated mooring tower
Class Notations:		
Notation:	**Description**	**Further information**
CSR	Assigned to floating offshore installations having previously been built as double hull oil tankers to IACS's Common Structural Rules	Generally indicates a hull fatigue life of 25 years from date of build.
CAC1, 2 or **3**	Crew Accommodation Comfort. Assigned to units which have crew accommodation and work areas compliant with standards for noise and vibration levels defined in the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5*.	*Pt 7, Ch 12, Passenger and Crew Accommodation Comfort* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5* Following the **CAC** notation, the numeral **1**, **2** or **3** will indicate the acceptance criteria to which the noise and vibration levels have been assessed.
FWS	Fresh Water System Assigned to units which have an installed fresh water system (including sea water desalination plant, if fitted) which complies with the Rules.	*Pt 5, Ch 24 Sea Water Desalination Plants and Fresh Water Systems*
LFPF (GF, NG or **EG** or **LP** or **HG** or **ML)**	Low flashpoint fuel. Assigned to units where the main propelling and/or auxiliary machinery is designed to operate on a low flashpoint fuel, or a combination of low flashpoint fuel and standard marine oil fuel, in accordance with the LR's *Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels, July 2016*. The low flashpoint fuel (or fuels) that the unit is designed to use is (are) indicated in the notation using a two letter identifier:	*Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels, July 2016*
PLS	Pipe Laying System. Optional notation assigned to mobile offshore units which are fitted with a pipe-laying system that is included in class.	*Pt 3, Ch 17 Pipe-laying Units*

■ *Appendix 2*

Descriptions

Descriptive qualification notes may be agreed indicating the type of unit in greater detail than is contained in the class notation, and/or providing additional information about the design and construction.

(*Part only shown*)

Descriptive Notes:		
Description	**Information**	**Further information**
GR (A,S,T,P,E(M,B,I))	Gas-Fuelled Readiness. Assigned to units, with the extension of one or more of the associated characters shown in brackets, detailing the aspects of design and construction that are in accordance with the *Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels, July 2016*	*Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels, July 2016*
National Authority (Norway, USCG, UK)	Assigned to units for which LR has carried out verification in accordance with the Regulations of a coastal state authority – which is identified within the parenthesis.	*Pt 1, Ch 4 Verification in Accordance with National Regulations for Offshore Installations*
Concrete hull		
Potable Water System		
Sea Water Desalination Plant		

Part 3, Chapter 1
General Requirements for Offshore Units

■ *Section 7*
Permanent means of access

7.1 General

7.1.1 Offshore units should be designed and built with due consideration as to how they will be surveyed during their in-service life and how it will be possible to monitor the condition of the unit. Each space within the unit should be provided with at least one permanent means of access to enable, throughout the life of a unit, overall and close-up inspections and thickness measurements of the unit's structures to be carried out by LR, the unit's personnel and others, as necessary. ~~Such means of access should comply with the provisions of *2009 MODU Code - Code for the Construction and Equipment of Mobile Offshore Drilling Units, 2009 – Resolution A.1023(26)*, paragraph 2.2 and with the Technical provisions for means of access for inspections, adopted by the Maritime Safety Committee by Resolution *Resolution MSC.133(76) - Adoption of Technical Provisions for Means of Access for Inspections - (adopted on 12 December 2002)*, as may be amended by the IMO.~~

7.1.2 Means of access should comply with the applicable provisions of *2009 MODU Code - Code for the Construction and Equipment of Mobile Offshore Drilling Units, 2009 – Resolution A.1023(26)*, paragraph 2.2 and with the Technical provisions for means of access for inspections, adopted by the Maritime Safety Committee by *Resolution MSC.133(76) - Adoption of Technical Provisions for Means of Access for Inspections - (adopted on 12 December 2002)*, subject to amendment by the IMO. *See* also *IACS Unified Interpretations for the application of MODU Code Chapter 2 paragraphs 2.1, 2.2, 2.3, 2.4 and revised technical provisions for means of access for inspections (resolution MSC.158(78))*.

7.1.3 Means of access should be provided to enable the close-up visual inspection of fatigue critical locations including those listed in *Pt 4, Ch 5, 5.2 Fatigue life assessment 5.2.1*, with the exception of those external locations which have been designed with a higher fatigue life factor of safety in order not to require inspection in accordance with *Pt 4, Ch 5 Primary Hull Strength*, *Table 5.5.1 Fatigue life factors of safety for structural components*.

7.1.4 Means of access should be designed in conjunction with a rescue plan to ensure that the safe rescue of personnel is as practicable as possible. Means of access should be sized and arranged appropriately for rescue equipment e.g. stretchers.

7.1.5 Where only one opening is provided to a space within the unit, it is to be demonstrated that adequate ventilation can be provided to the space without excessively obstructing the opening. The single opening is to be sized to allow human access in parallel with a flexible air duct in the same opening. Alternatively, spaces without permanent ventilation arrangements should be provided with a small secondary ventilation opening big enough for a flexible air duct.

7.1.6 Access arrangements should be provided to facilitate the inspection and maintenance scheme of the protective coating systems including coatings required by Resolution MSC.215(82) - *Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks in all Types of Ships and Double-Side Skin Spaces of Bulk Carriers - (Adopted on 8 December 2006) Performance Standards for Protective Coatings*. Access arrangements should consider access for tools and to facilitate cleaning, drainage and drying of the space to be coated. Where practicable, access arrangements for the inspection and maintenance of coatings should be combined with those for structural inspections.

Part 3, Chapter 2
Drilling Units

■ *Section 2*
Structure

2.6 Deckhouses and modules

2.6.2 Offshore containers are to comply with *Pt 3, Ch 4, 2.4 Offshore containers*.

~~2.6.2 The strength of containerised modules which do not form part of the main hull structure will be specially considered in association with the design loadings.~~

~~2.6.3 When containerised modules can be subjected to wave loading the scantlings are not to be less than required by 2.6.1.~~

Part 3, Chapter 3
Production and Storage Units

■ *Section 2*
Structure

2.7 Deckhouses and modules

2.7.2 Offshore containers are to comply with *Pt 3, Ch 4, 2.4 Offshore containers*.

~~2.7.2 The strength of containerised modules, which do not form part of the main hull structure, will be specially considered in association with the design loadings.~~

~~2.7.3 When containerised modules can be subjected to wave loading, the scantlings are not to be less than required by *Pt 3, Ch 3, 2.7 Deckhouses and modules 2.7.1.*~~

Part 3, Chapter 4
Accommodation and Support Units

■ *Section 1*
General

1.1 Application

1.1.3 ~~The requirements for fire-fighting units are given in Pt 3, Ch 5 *Fire-fighting Units*.~~
Requirements for support units for the following functions are given in separate Chapters as follows:
(a) Fire-fighting Units *see Pt 3, Ch 5 Fire-fighting Units.*
(b) Pipe-laying Units *see Pt 3, Ch 17 Pipe-laying Units.*

1.2 Class notations

1.2.3 In general, units complying with the requirements of this Chapter and the relevant Parts of the Rules will be eligible for the assignment of one of the following class type notations, as appropriate:

- Accommodation unit.
- Crane unit.
- Diving support unit.
- Support unit.
- Multi-purpose support unit.
- ~~Pipe-laying unit.~~

1.3 Scope

1.3.1 The following additional topics applicable to the class type notation are covered by this Chapter:

- Strength of structure for accommodation.
- Supports for accommodation modules.
- Structure in way of diving installations.
- Structure in way of cranes.
- ~~Structure in way of pipe-laying equipment.~~
- Bilge systems and cross-flooding arrangements on accommodation units.
- Electrical installations on accommodation units.

■ *Section 2*
Structure

2.1 Plans and data submission

2.1.1 In addition to the structural plans and information as required by *Pt 3, Ch 1, 2 Information required* and *Pt 4, Ch 1, 4 Information required*, the following additional plans and information are to be submitted as applicable:

- Structural plans of the accommodation including deckhouses and modules.
- Design calculations for containerised modules.
- Module support frames or skids and details of attachments.
- Structural arrangements and supports under diving installations.
- Structural arrangements in way of crane supports.
- ~~Structural arrangements and supports under pipe laying equipment.~~

2.2 General

2.2.1 The general hull strength is to comply with the requirements of *Pt 4 STEEL UNIT STRUCTURES*, taking into account the applied weights and forces due to the accommodation, diving installations~~, pipe laying equipment~~ and cranes, and the local structure is to be suitably reinforced. Attention should be paid to loads resulting from hull flexural effects at support points.

Existing paragraph 2.2.4 has been renumbered 2.4.6.

~~2.2.5 The structural strength of the connections between containerised modules and the supporting frame or structure are to comply with the general strength requirements of *Pt 4, Ch 6, 9 Superstructures and deckhouses*, taking into account the unit's motions and marine environmental aspects.~~

~~2.2.6 The connections of containerised modules are also to satisfy an emergency static condition with an applied horizontal force F_H in any direction as follows:~~
~~$F_h = W \sin \theta$ N (tonne f)~~
~~where~~
~~$\theta = 25^o$ for semi-submersible units~~
~~$\theta = 17^o$ for self-elevating units~~
~~W = weight of the modules supported in N (tonne-f)~~

~~2.2.7 In the emergency static condition defined in *Pt 3, Ch 4, 2.2 General 2.2.6* the permissible stress levels are to be in accordance with *Table 5.2.1 Factors of safety for the combined load cases – load case (d)* in *Pt 4, Ch 5, 2 Permissible stresses*~~

2.4 Offshore containers

2.4.1 **Definition**. For the purposes of this sub-Section, offshore containers are defined as portable units for repeated use in the transport of goods or equipment handled in open seas to, from and between fixed and/or floating installations and ships. Offshore containers are subdivided into three categories:

(a) **Offshore freight containers**

An offshore container built for the transport of goods. Examples of offshore freight containers are:

(i) General cargo container. A closed container with doors;
(ii) Cargo basket. An open top container for general or special cargo;
(iii) Tank container. A container for the transport of dangerous or non-dangerous fluids. Tote tanks are considered tank containers;
(iv) Bulk container. A container for the transport of solids in bulk;
(iv) Special container. A container for the transport of special cargo e.g. garbage containers, equipment;
(vi) Boxes and gas cylinder racks.

(b) **Offshore service containers**

An offshore container built and equipped for a special service task, usually as a temporary installation e.g. laboratories, workshops, stores, power plants and control stations.

(c) **Offshore waste skip**

An open or closed offshore container used for the storage and removal of waste.

2.4.2 Offshore containers are to be certified to IMO MSC/Circ.860 as supported by BS EN 12079-1:2006 *Offshore containers and associated lifting sets. Design, manufacture and marking* or an equivalent recognised Standard. The containers are to be certified by an IMO classification body certified for such services on their ISO 17020 accreditation scope. Containers may be certified using LR's Container Certification Scheme.

2.4.3 Additional requirements are required for offshore portable tanks which store dangerous fluids e.g. aviation fuel and pipeline pre-commissioning chemicals. These require the certifying body to hold the applicable regulatory approvals (e.g. for the International Maritime Dangerous Goods Code and additionally for aviation fuel CAP 437 *Standards for Offshore Helicopter Landing Areas*).

2.4.4 In-service, offshore containers are required to be inspected as per the offshore standards at a maximum duration of every 4 years, and with a visual inspection performed annually. The inspection body is required to be accredited (e.g. to ISO 17020) for such activities. Any NDT undertaken is to comply with the standard requirements (e.g. NDT operators to Level 2 of ISO 9712 for EN 12079-

2). The inspection reports are to be submitted to LR. Where it is intended to keep a container on-board for more than one year, it is to be located with sufficient access to allow inspection and repair of the container in-situ, including load testing of the lifting sets where applicable.

2.4.5 Offshore portable tanks used as bulk storage vessels associated with the drilling plant or process plant are additionally to comply with the requirements of *Pt 3, Ch 7, 4 Bulk Storage wet and dry systems* or *Pt 3, Ch 8, 4 Pressure Vessels and bulk storage*, as applicable.

~~2.2.4~~ 2.4.6 When ~~containerised modules~~ offshore containers can be subjected to wave loading or protect openings leading into buoyant spaces, the scantlings are not to be less than required by *Pt 3, Ch 4, 2.2 General 2.2.2*.

2.4.7 The deck connections and supporting structure for offshore containers are to be designed to the load cases in *Pt 4, Ch 3, 4.3 Load combinations* for all operating and transit conditions for the applicable loads defined in *Pt 4, Ch 3, 4 Structural design loads*. The permissible stress levels are to be in accordance with *Table 5.2.1 Factors of safety for combined load cases* in *Pt 4, Ch 5, 2 Permissible stresses*.

2.4.8 The deck connections and supporting structure for offshore containers are additionally to be designed for an emergency static condition with the unit inclined to the following angle:

- Column-stabilised and tension-leg units:
  25° in any direction.
- Surface type units:
  22,5° heel, port and starboard, and trimmed to an angle of 10° beyond the maximum normal operating trim.
- Self-elevating units:
  17° in any direction in transit conditions only.

These angles may be modified by LR in particular cases as considered necessary. In no case is the inclined angle for the emergency static condition to be taken as less than the maximum calculated angle in the worst damage condition in accordance with the appropriate damage stability criteria. The permissible stress levels are to be in accordance with load case (d) in *Table 5.2.1 Factors of safety for combined load cases* in *Pt 4, Ch 5, 2 Permissible stresses*. The maximum operating weights of the offshore containers are to be assumed. Where applicable, ice and snow loads are to be included. Wind loads need not be considered to be acting during this emergency condition.

2.4.9 Container securing arrangements for stowage on exposed decks are to comply with the applicable requirements of *Pt 3, Ch 14, 5 Container securing arrangements for stowage on exposed decks without cell guides* of *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5*.

Part 3, Chapter 9
Dynamic Positioning Systems

■ *Section 8*
Dynamic Positioning Systems for Pipe-laying Units

8.1 General

8.1.1 Pipe-laying units with installed dynamic positioning systems which are required to operate in close proximity to offshore units or installations are to comply with the requirements for class notation **DP(AA)**, *see Pt 3, Ch 9, 4 Class notation DP(AA)* or **DP(AAA)** *see Pt 3, Ch 9, 5 Class notation DP(AAA)*.

8.1.2 The thruster and propulsion units should provide good position keeping capabilities in the intact and the worst case failure conditions. For such conditions, the mean tension required for working with the highest pipe tension load for which the unit is designed is to be accounted for in the force vectors of the dynamic positioning system.

8.1.3 The control system software for the dynamic positioning system should be provided with a tension input for pipe-laying operations to ensure that pipe lay initiation, lay down and recovery are included in the dynamic positioning control model. It is essential that this tension input is accurate, redundant and reliable to ensure position keeping performance and stability.

8.1.4 The systems and equipment on board should be such that no single failure of the pipe lay or positioning system would result in the total loss of the tension in the pipe or loss of position stability. The tensioners should be designed with the same level of redundancy as the dynamic positioning system and a Failure Modes and Effects Analysis (FMEA) should be performed on the pipe lay system and its interaction with the dynamic positioning system.

Part 3, Chapter 10
Positional Mooring Systems

■ *Section 4*
Design aspects

4.1 Design cases

4.1.3 A load case considering the failure of any one line adjacent to the first failed line should be run to assess the consequence of such a serial failure considering design environmental combinations not less onerous than 10 year return period sea state + 10 year return period wind and associated current at 95 per cent non-exceedance level. The results of the analyses of the positional mooring system with two lines failed should indicate this abnormal configuration does not lead to progressive collapse or incidents of substantial consequences such as loss of life, uncontrolled outflow of hazardous or polluting products, collision, sinking. ~~Mooring line failure response procedure should be referred to from the time one line fails.~~ For this load case, a factor of safety of one is to be applied to the line minimum breaking load at the 'end of life' condition (i.e. excluding corrosion allowance).
The results (offsets, tensions, clearances, etc.) of the two lines failure analyses are to be reported and used to set up the mooring line failure response procedure for the unit.
Notes
1. The mooring line failure response procedure should be referred to from the time one line fails.
2. The mooring line failure response procedures shall include root cause assessment, repair planning, mitigations to limit further damage, ensure safe control of the Offshore Unit after failure of one line and ensure preparedness for further line failure will not have substantial consequences.

■ *Section 6*
Anchor lines

6.1 General

6.1.4 In general, the break strength of ~~the~~ an anchor or mooring lines is not to be greater than the load bearing capacity of the ~~connecting~~ structure it connects to. Unless when specifically designed as a weak link in the mooring line chain or rope fittings, sockets, shackles, H or Y type links, connectors etc. shall be designed based on mooring line pull at least equal to the as new nominal minimum break strength of the mooring line main component (steel wire rope, chain or fibre rope) applying a minimum contingency factor of 1.1.

~~For chain or rope loose fittings, sockets, shackles, connectors etc. the design shall be based on mooring line pull at least equal to the as new nominal minimum break strength of the mooring line main component (steel wire rope, chain or fibre rope) applying a minimum contingency factor of 1.1.~~

In long term positional mooring systems, H or Y type links are often used as connectors in preference to standard D joining shackles, as their design is not standardised and they are specifically designed to suit the components they connect. When standard D type joining shackles are used in positional systems, their designs shall be checked and confirmed suitable for the specific connection arrangement, fit and resulting constraints.

For fairleads, bending shoes, ~~and~~ stoppers and their supporting structures *see ~~Pt 3, Ch 10, 10 Fairleads and cable stoppers~~ Pt 3, Ch 10, 10 Fairleads, bending shoes and stoppers*. For supporting structure *see Pt 4, Ch 6, 1 General requirements 1.6*.

■ *Section 8*
Chains

8.2 Corrosion and wear

8.2.1 A size margin over and above the minimum chain size required to satisfy Rule factor of safety requirements is to be included to allow for the corrosion and wear which can occur over the intended service life of the anchor chain or associated component. The minimum margins shown in *Pt 3, Ch 10, 8.2 Corrosion and wear 8.2.1* are ~~recommended~~ required.

Note: These rates are minimum ~~recommendations~~ requirements. The actual rate of corrosion should be monitored during successive periodical surveys to ~~access~~ assess the necessity to replace the chains in case accelerated corrosion or excessive pitting is observed. It should be noted that in tropical and subtropical regions as well as some coastal areas much greater rates of corrosion (sometimes exceeding twice these rates through localised pitting) have been observed. The Owner is to specify their corrosion protection strategy and may specify a larger minimum rate of corrosion for specific projects, taking due account of the region of operation of the unit.

■ *Section 10*
Fairleads, bending shoes and ~~cable~~ stoppers

10.1 General requirements

10.1.1 ~~Fairleads and stoppers are to be designed to permit free movement of the anchor line in all mooring configurations and designed to prevent excessive bending and wear of the anchor lines. The hardness of fairleads and chain stoppers where in contact with the anchor line should be softer than the anchor line. In general, the anchor line should not be in contact with any welds but where this is not possible the welds are to be ground flush and are to be softer than the anchor line.~~

This Section presents the general requirements applicable to the design of fairleads, bending shoes and stoppers. Within the context of this sub-Section:

- Mooring lines are an assembly of loose mooring components (generally of standard design) connected together. One end is hooked up to and held onto the Offshore Unit via a stopper and may pass through a number of connecting components (e.g. stopper, bending shoe or fairlead etc), the other end is connected to an anchor point (generally on the seabed), mainly transferring tension between one end and the other. Mooring lines and their components can generally be readily connected to, disconnected from, and paid into or out of the offshore unit.
- Fairleads, bending shoes and stopper components consist of all components (generally articulated in relation to their supporting structures) in the load path between mooring line and support structure (generally articulated, or in contact with it but not welded to it) and ensuring the load transfer between mooring line components and their supporting structures as well as ensuring and accommodating the free rotation of the top end of the mooring line (in relation to their supporting structures) at its top end connection point.
- Fairleads, bending shoes and stopper supporting structures generally refer to welded plate and stiffened structures, fixed (generally welded) to the main hull, deck or turret hull structure of the offshore unit as well as part of the hull, deck or turret structure, the design of which is affected locally by loads imparted, by the mooring lines, and transferred through the fairleads, bending shoes and stoppers main components. Parts of the primary hull structure of the offshore unit (e.g. main hull, pontoons, columns, turret body, decks bulkheads or other similarly essential structures) may contribute to structural capacity of the supporting structures to Connecting components and their design shall comply with both the requirements of *Pt 4, Ch 5 Primary Hull Strength* and *Pt 4, Ch 6 Local strength* and be consistent with design requirements of this Section.

10.1.2 ~~The minimum operating range of the fairlead to be considered in conjunction with the design load is shown in Fig. 10.11.1.~~ Connecting components are to be designed to permit free movement of the anchor line in all mooring configurations and designed to prevent excessive bending and wear of the anchor lines. The hardness of connecting components in direct contact with mooring line components should be softer than the mooring line components. In general, the anchor line should not be in contact with any welds. Where this cannot be avoided, the welds are to be ground flush and softer than the mooring line (limited to low stress areas of the mooring line components) and an increase in wear allowance shall be considered and substantiated for the specific service conditions e.g. (potential chaffing).

10.1.3 ~~Fairleads and stoppers and their supporting structures are to be designed for a mooring line pull load equivalent to:~~

- ~~the mooring line maximum design load as defined from intact mooring load case (as defined in *Pt 3, Ch 10, 4 Design aspects*, *Pt 3, Ch 10, 5 Design analysis* and *Pt 3, Ch 10, 6 Anchor lines*) for a range of mooring line pull angles as substantiated by analyses (including a 5 degrees contingency)~~

~~and~~

- ~~the maximum break strength of the main component (steel wire rope, chain or fibre rope), in "as new" condition, directly acting on or closest in the load path to the structure under consideration. The range of mooring line pull direction shall match that reported in Section *Pt 3, Ch 10, 10.1 General requirements*. The maximum break load is generally to be based on expected maximum break strength plus two standard deviations (when sufficiently document from manufacturefs test data), otherwise not less than 110% of the nominal minimum break strength of the mooring line component.~~

  ~~For this case, special consideration will be given to acceptance of local yielding and deformation of fairleads and stoppers when it can be shown:~~

  ~~The support structure to the fairlead or stopper satisfies the requirement of*Pt 4, Ch 6, 1.1 General* .~~

  ~~The deformation does prevent repair or replacement, does not otherwise affect the integrity of the overall hull, does not lead to progressive collapse, has no substantial consequences, such as, loss of life, uncontrolled outflow of hazardous or polluting products, collision, sinking.~~

  ~~The fairlead or stopper can be readily inspected and can be repaired or replaced offshore. Specific inspections, repair or replacement procedures are documented in IMR Manual and sparing policy ensures spares are readily and locally available.~~

~~The maximum permissible stresses for the design cases given in this sub-Section are to be in accordance with*Table 5.2.1 Factors of safety for the combined load cases* – load case (d) in *Pt 4, Ch 5, 2 Permissible stresses*.~~

Fairleads, bending shoes and stoppers and their supporting structures are to be designed for a mooring line pull load equivalent to:

(a) Actions from the mooring line under maximum mooring line design load as defined from intact and one line failed mooring load cases (as defined in *Pt 3, Ch 10, 4 Design aspects*, *Pt 3, Ch 10, 5 Design analysis* and *Pt 3, Ch 10, 6 Anchor lines*). For this load case:

- The maximum mooring line design load shall be taken as the most probable maximum mooring line load of the most loaded line as defined from intact and one line failed mooring load cases (as defined in *Pt 3, Ch 10, 4 Design aspects*, *Pt 3, Ch 10, 5 Design analysis* and *Pt 3, Ch 10, 6 Anchor lines*).
- The range of mooring line pull angles shall be as substantiated by analyses augmented by a five degrees contingency.
- When the supporting structure is affected by loading from more than one mooring line (transmitted through fairlead, bending shoe or stopper), the design shall encompass the most onerous combination of loads from the other lines (when the most

loaded line is subject to a load equal or greater than the most probable maximum load) as substantiated by the mooring analyses of corresponding intact and one line failed cases.

- Support structure to fairlead, bending shoe or stopper shall fully satisfy the requirements on maximum permissible stresses for the design cases given in this sub-Section are to be in accordance with Load case (b) in *Table 5.2.1 Factors of safety for the combined load cases* in *Pt 4, Ch 5, 2.1 General*.
- Fairlead, bending shoe and stopper components shall satisfy the requirements on allowable stresses based on factors of safety from *Table 10.11.2 Load Case Factors of safety*, Load case 3 (with the exception of contact areas).
- Fairlead, bending shoe and stopper components may be subject to very localised yielding limited to contact areas.
- The design shall demonstrate that such yielding will impair neither their long term performance nor that of the mooring line component they act upon and that further to an initial shake down, further loading (as substantiated from mooring analyses) will not lead to further yielding. As such the design shall demonstrate that after yielding under the worst design load considered in this load case, an effective shake down is achieved ruling out any further detrimental yielding and ratcheting.

(b) Actions from the mooring line under maximum break strength of the main line component (steel wire rope, chain or fibre rope), in 'as new' condition, directly acting on or closest in the load path to the structure under consideration. For this load case:

- The maximum break load is generally to be based on either the expected maximum break strength plus two standard deviations when substantiated by statistically significant test data from the manufacturer of the main line component or a load not less than 110 per cent of the nominal minimum break strength of the mooring line component it interacts with. For cases where the minimum break strength of such a mooring line component, is governed by cyclic fatigue damage rather than extreme or accidental (two lines failed) loads, and the component can be shown to be most unlikely (i.e. so unlikely it can be assumed it will not occur over the installation and service life) to be pulled to its minimum break strength. Special consideration will be given to limiting line pull to the minimum break strength of the mooring component next in line. This will be on the basis of a documented risk assessment taking into account the specific design arrangement, as well as service and mooring line hook-up and pretension phases.
- The range of mooring line pull angles shall match that reported in *Pt 3, Ch 10, 10.1General requirements 10.1.2*. For stoppers, special consideration will be given to limiting the range of mooring line pull angles to only encompass largest angles of pull from the two line failed load case and angles up to the most unlikely (i.e. unlikely but possible to occur once over the installation and service life) on the basis of a documented risk assessment, considering the specific design arrangement, as well as service and mooring line hook-up and pretension phases.
- When the supporting structure is affected by loading from more than one mooring line (transmitted through fairlead, bending shoe or stopper), the design shall encompass the most onerous combination of loads from the other lines (as substantiated by the mooring analyses of corresponding intact and two line failed cases).
- Support structure to fairlead, bending shoe or stopper shall fully satisfy the requirements on maximum permissible stresses for the design cases given in this sub-Section in accordance with Load case (d) in *Table 5.2.1 Factors of safety for the combined load cases* in *Pt 4, Ch 5, 2.1 General*.
- The hull structure (offshore unit hull and deck or turret buoy hull etc.) is to be shown in compliance with all other Rules requirements as applicable. *See also Pt 4, Ch. 6, 1.1 General 1.1.6.*
- Fairlead, bending shoe and stopper components shall satisfy the requirements on allowable stresses based on factors of safety from *Table 10.11.2 Load Case Factors of safety*, Load cases 1 and 2 (exception made for local yielding areas).
- Special consideration will be given to acceptance of local yielding and deformation of components of the fairleads, bending shoes and stoppers when it can be shown:
  - Local yielding and associated deformation prevent neither repair nor replacement of the components; affect neither the integrity of the support structure nor the main structure of the offshore unit (e.g. main hull, pontoons, columns, turret, decks, bulkheads or other structures otherwise essential to the integrity of the offshore unit), which are to be shown in compliance with all other Rules requirements as applicable. Local yielding and deformation shall not impair the long term performance of fairleads, bending shoes or stoppers or their supporting structures, and leads to neither progressive collapse, nor substantial consequences (such as, loss of life, uncontrolled outflow of hazardous or polluting products, collision, sinking).
  - Fairleads, bending shoes, and stoppers support structures are generally attached locally to the primary hull or deck structures. Primary hull or deck structures are generally subject to global loads and associated deflections. The design of fairleads, bending shoes, stoppers support structures shall account for the stiffness, loading and associated deflections of the primary hull or deck structures. As such it is recommended that the Finite Element -model includes part of the primary hull or deck structures to which fairleads, bending shoes, stoppers support structures are integrated e.g. from a significant primary structural member, bulkhead, or other suitable boundary.
  - Fairleads, bending shoes, and stopper support structures should be designed to be readily inspected following documented specific inspection procedures.
  - Fairleads, bending shoes, and stopper components subject to yielding which could impair the long term performance of their arrangement should be designed to be readily inspected and repaired or replaced offshore (including when and where applicable after expected yielding and deformation). Inspection, repair or replacement procedures shall be documented in an Inspection, Maintenance and Repair Manual including sparing policy, ensuring spares are readily and locally available. Alternatively, prototype tests or pertinent empirical evidence shall further substantiate the capacity of the design to withstand the loading and associated yielding without the long term performance being significantly affected. The scope, procedure and criteria of such prototype tests shall be submitted to LR for review and acceptance. Actual prototype testing is to be witnessed by an LR Surveyor and the results reported to LR for review as part of the design appraisal process.
- Fairleads, bending shoes, stopper components or associated support structures designed on the sole basis of finite element analyses shall have all main structural welds and areas anticipated by design to be subject to plasticity, subject to non-destructive examination as follows at manufacture:
  - 100 per cent visual.
  - 100 per cent MPI.
  - 100 per cent UT/radiographic, for full penetration welds.

Such examinations shall be performed under LR surveillance during manufacturing survey.

10.1.4 ~~Fairleads, stoppers and support structures shall also be assessed for the mooring line load from damaged mooring load case (as defined in Section *Pt 3, Ch 10, 4 Design aspects*,*Pt 3, Ch 10, 5 Design analysis* and *Pt 3, Ch 10, 6 Anchor lines*) for a range of mooring line pull angles as substantiated by analyses (including a 5 degrees contingency) The maximum permissible stresses for the design cases given in this sub-Section are to be in accordance with *Table 5.2.1 Factors of safety for the combined load cases* – load case (d) in *Pt 4, Ch 5, 2 Permissible stresses*.~~ Non-linear finite element methods may be used to assess the structural capacity of components subject to plasticity and the circumstances under which they are able to withstand such yielding. Such a design methodology shall generally follow recognised recommended practice (with respect to such aspects as element types, mesh sizes, application of loads and constraints, boundary conditions, convergence, calibration material curves, imperfections, residual stresses etc.) and be submitted to LR for review and acceptance as part of the design appraisal. The non-linear finite element method shall take into account the following design requirements:

- Pertinent material true stress strain curves from recognised codes or standards, representative of the materials nominal properties and based on conservative idealisation, shall be referred to. Material testing shall confirm the validity of such design curves. When such a curve is developed for the purpose of a specific design, this should be based on sufficient tests to provide a reliable nominal characteristic value. Ramberg-Osgood material model is commonly referred to in such analyses.
- Monotonic material properties should be complemented with cyclic material properties both substantiated by test data demonstrating the conservatism of the model.
- Effective stress-strain shake down shall be substantiated by tests demonstrating that, after application of a load representative of the maximum design load (resulting in a greatest level of plasticity), cyclic plasticity rapidly reduces and the material re-exhibits an elastic behaviour in subsequent load cycles (taking due account of the loading expected in service).
- Such tests shall also be performed to confirm that any incremental plasticity resulting from representative in-service cyclic loading will not accumulate a level of plastic strains exceeding the strain criteria set for the design.

When performing tests to substantiate the properties of the models for a specific design, this should be based on sufficient tests data to provide reliable nominal values (generally based on mean offset by at least two standard deviations) and ensure actual values have less than five percent probability of being unconservative.

The methodology shall propose limits on plastic strain pertinent to the specific design. While a basic limit on plastic strain of five percent is often referred to in the industry and can generally be found appropriate, the proposed strain criteria shall be substantiated (either by reference to recognised and pertinent codes and standards or empirical evidence or more generally by test data) for the specific load case/failure mechanism highlighted above. The material and location of the yielding area in relation to welds, should take due account of cyclic loading effects, service loads and service conditions e.g. temperature and corrosion.

10.1.5 Materials and steel grades of the support structures are generally to comply with the requirements given in *Pt 4, Ch 2 Materials* for primary structures, except where highly stressed, where grades appropriate to 'Special' structural category shall be considered. Similarly highly stressed fairleads, bending shoes and stoppers components shall be made of material and steel grades assigned to the structural category 'Special' in compliance with *Part 4, Ch 2 Materials*.

10.1.6 Chain cable fairleads are to have a minimum of ~~five pockets~~ seven pockets. Special consideration will be given to designs with five pockets only. Strength and fatigue design of chain links passing through and bearing on such fairleads shall take into account frictional and bending effects, as well as the additional damage due to their interaction with the fairlead. Increases in wear allowances shall be substantiated for such service conditions.

10.1.7 Wire rope fairleads are generally to have a minimum diameter of 16 times the wire rope diameter. Strength and fatigue design of the steel wire ropes passing through and bearing against such fairleads shall take into account bending and crushing effects and the additional damage due to the interaction with the fairlead. Increases in wear allowances shall be substantiated for such service conditions.

10.1.8 Special consideration will be given to permissible stresses where the chain is of downgraded quality. ~~There have been cases of closing plates on the fairlead shaft coming loose due to corrosion of the threads of the securing bolts, resulting in serious damage to the fairlead arrangements and the complete jamming of the fairlead and chain. Consequently, the securing bolts should also be checked to ensure that the bolt material does not corrode preferentially should the sacrificial anode system fail to function in way of the fairlead.~~

10.1.9 ~~For permanent mooring systems it~~ It is recommended that ~~those~~ lengths of the mooring lines which lie over a fairlead or bending shoe or other ~~similar~~ components with a curved surface are not maintained in such a condition for ~~any~~ an extended period of time ~~at the operating~~ under significant tension that would normally apply to the main part of the lines, but rather only for temporary line tension adjustments that might be necessary for inspection, maintenance or repair. It is generally preferable to have a suitably designed stopper holding the mooring line load outboard of the fairlead. Where applicable the long term detrimental effect of the wheel type fairlead action on the mooring line should be assessed and documented. Note~~:~~ the recommendations from API RP 2SK ~~etc.~~ on such aspects.

10.1.10 Fairleads ~~H~~hawse ~~pipes,~~ or guide pipes, ~~or~~ and bending shoes ~~and fairleads etc. used in the mooring system are to have~~ interacting with the mooring line shall have adequate strength for the imposed loads. Detailed assessment of the interaction between these devices and mooring line chain links or ~~cable~~ wire rope shall be documented. Their design ~~should~~ shall take into account the friction, inter-link locking mechanism and the side loads required to align the device (fairleads, hawse or guide pipes, bending shoes, fairleads) with the ~~cable~~ mooring line through swivel or articulation, as well as the intermittent contact and interaction in ~~the~~ areas where the mooring line separates from their support or bearing surfaces. ~~Hawse pipes or guide pipes when located inside tanks are to shall also be designed for sloshing forces).~~ Close fit between mooring line components and ~~mooring line~~ bearing surfaces as well as

their geometrical arrangement shall be designed to minimise detrimental wear, bending and associated stress concentrations in both mooring line and the ~~mooring line~~ bearing surface arrangement.
Chain or wire rope hawse or guide pipes when located inside tanks shall also be designed for sloshing forces.
The design of fairleads hawse or guide pipes and bending shoes shall ensure the mooring line component passing through them and bearing surfaces (points of interaction) can be inspected.

10.1.11 Sensitivity of the design to the actual long term performance of the bearings ~~are~~ is to be considered and the loads it may be subject to during its design life taken into consideration.

10.1.12 ~~The fairlead~~ Fairleads, bending shoes and stoppers ~~and bending shoes~~ shall be protected against corrosion and designed such that their long term performances (throughout their design life) ~~are~~ is not affected by corrosion.

10.1.13 There have been cases of closing plates on the fairlead shaft coming loose due to corrosion of the threads of the securing bolts, resulting in serious damage to the fairlead arrangements and the complete jamming of the fairlead and chain. Consequently, the securing bolts should also be checked to ensure that the bolt material does not corrode preferentially should the sacrificial anode system fail to function in way of the fairlead.

10.1.14 Fairleads, bending shoes, stopper components and their supporting structures are to be designed for the cyclic loading they will be subject to over their design service life. Design service life of supporting structure shall be assessed using a method consistent with that applied to the hull structure, and that of the components shall be assessed using a method consistent with mooring line components.

■ *Section 13*
Thruster-assisted positional mooring

13.1 General

13.1.1 Thrusters which provide safety functions are subject to the requirements of classification.

13.1.2 Thrusters used for positioning of the unit into the weather during normal operation to minimise motions of the unit and optimise production are not normally considered to be providing a safety function and therefore not subject to classification.

13.1.3 Thrusters used for heading control of the unit during side to side offloading operations may be subject to the requirements of classification depending on the operational intent during offloading. An appropriate risk assessment using a methodology acceptable to LR shall be carried out to determine whether the thrusters are providing a safety function and classed for such offloading duty or not.

13.1.4 The risk assessment shall consider whether the thrusters are providing any safety functions before, during or at the end of off-loading.

13.1.5 The risk assessment shall consider the boundary of the system to be assessed. This boundary condition should include items such as offloading arms, ship to ship coupling and decoupling systems that are structurally attached to the vessel.

13.1.6 The risk assessment should be carried out in accordance with a recognised National or International Standard, such as those detailed in IEC/ ISO 31010 *Risk Management – Risk Assessment techniques*; *see also Pt 3 Ch 15, 1.1 General* for the use of a risk assessment to identify safety critical systems.

13.1.7 Where a Thruster-assisted positioning system is classed, it shall be for a clearly defined operational duty. Should the operational duty change, the system shall be subject to a new risk assessment.

~~13.1~~ 13.2 ~~General~~ Class Notations

~~13.1.1~~ 13.2.1 Where the positional mooring system is assisted by thrusters, as defined in *Pt 3, Ch 10, 4 Design aspects*, units complying with the requirements of this Section together with the requirements in *Pt 3, Ch 10, 13 Thruster-assisted positional mooring* will be eligible for one of the following class notations as specified in 1.2:

TA(1) *See* ~~13.1~~14.1.
TA(2) *See* ~~13.2~~.14.2
TA(3) *See* ~~13.3~~14.3.

~~13.1.2~~ 13 2.2 Machinery items are to be constructed, installed and tested in accordance with the relevant requirements of *Pt 5* Main and Auxiliary Machinery, together with the requirements of ~~13.2~~ 13.3 and Section 14.

Existing sub-Section 13.2 has been renumbered 13.3.

~~13.3~~ 13.4 Electrical equipment

~~13.3.1~~ 13.4.1 The electrical installation is to be designed, constructed and installed in accordance with the relevant requirements ~~of*Pt 6, Ch 2 Electrical Engineering*~~ of *Pt 6, Ch 2 Electrical Engineering* together with the requirements of ~~13.3.3~~ 13.4.3 to ~~13.3.8~~ 13.4.8, and the relevant requirements of *Pt 3, Ch 10, 14 Thruster-assist class notation requirements*.

Existing paragraphs 13.3.2 to 13.3.8 have been renumbered 13.4.2 to 13.4.8.

~~13.4~~ 13.5 Control engineering systems – Additional requirements

Existing paragraphs 13.4.1 to 13.4.4 have been renumbered 13.5.1 to 13.5.4.

~~13.4.5~~ 13.5.5 Abnormal signal errors revealed by the validity checks required by ~~13.4.4~~ 13.5.4 are to operate alarms.

Existing paragraphs 13.4.6 to 13.4.8 have been renumbered 13.5.6 to 13.5.8.

~~13.4.9~~ 13.5.9 Sufficient instrumentation is to be fitted at the central control station to ensure effective control and indicate that the system is functioning correctly, *see* ~~13.4.2~~ 13.5.2.

Part 3, Chapter 13
Buoys, Deep Draught Caissons, Turrets and Special Structures

■ *Section 1*
General

1.8 Plans and data submission

1.8.1 Plans are to be submitted for approval as required by the relevant Parts of the Rules together with applicable plans, calculations and information to cover the additional topics listed in this Chapter, as applicable. These plans are to clearly indicate the scantlings, joint details and welding, or other methods of connection. In general, plans are to include the following where applicable:

- An arrangement plan of watertight compartments, including the location, type and disposition of watertight and weather tight closures.
- Structural arrangement showing shell plating, framing, bulkheads, flats, main and bracing members, joint details, as applicable.
- Details of watertight doors and hatches.
- Welding details and procedures.
- Corrosion control arrangement.
- Type, location and amount of permanent ballast, if any.
- Bilge, sounding and venting arrangements.
- Hazardous areas classification drawings.
- Electrical system one line diagrams.
- Location of fire safety equipment.
- Mooring arrangement.
- Mooring components including anchor leg, associated hardware, hawser, and hawser load deflection characteristics.
- Foundations for mooring components, industrial equipment, etc. showing attachments to hull structure.
- Anchoring system showing the size of anchor, holding capacity of piles, pile sizes, and capacity, etc.
- PLEM (Pipe Line End Manifold).
- SPM main bearing.
- Cargo or Product swivel including swivel driving mechanism, swivel bearing, electrical swivel details.
- Product or cargo system piping schematic drawing with bill of materials.
- Design data of equipment, piping, and related components including minimum and maximum design pressure and temperature.
- Ancillary piping system schematic drawing with bills of material.
- Floating and under buoy hoses/flexible risers.
- Telemetry/Control system.
- Navigation aids.
- Methods and locations for NDT.
- Plans for conducting underwater inspections in lieu of dry docking.
- Test and inspection plan for all major load carrying or pressure retaining components including cargo or product swivel, electrical swivel, bearings.
- Test procedures.

1.8.2 A single copy of the following supporting plans, data, calculations or documents are to be submitted:

- Anchors and tether system components.
- Motion envelopes (single-point mooring, risers and tethers, as applicable).

- Floating stability.
- Strength and fatigue of structural and mechanical parts.
- Design specification.
- Environmental report.
- General arrangement.
- Materials specification, structural categories, welding details, NDE, connections, structural details and fabrication tolerances.
- Model test report.
- Operating instructions.
- Loadout and site installation procedure.

■ *Section 3*
Turret structures

3.1 General

3.1.1 ~~Turret structures supporting multi-point mooring line arrangements are to be assessed for the maximum combined forces to which they may be subjected to in service. The turret structure is to be suitable for the appropriate maximum single-point mooring line loads and in addition the critical mooring line group loadings.~~ A turret is part of a single point mooring system that is an integral part the offshore unit main structure. Turrets can be a cantilevered extension of the hull via mooring arms or yokes (external turrets), or can be internally integrated to the unit (internal turrets). Both internal and external turrets allow the unit to weathervane around the single point mooring.

3.1.2 ~~Environmental criteria and loading are in general to be in accordance with *Pt 10 SHIP UNITS*.~~ As opposed to buoys, turrets are not self-buoyant and most of the load from the turret weight, mooring lines and risers is transmitted to the main structure (disconnectable turrets are provided with residual buoyancy in order to remain in mid-water while disconnected for ease of retrieval). Special attention should be given to the load transfer from the turret to the hull structure as per the requirements of this Section.

~~3.1.3 Account is to be taken of wave slamming effects, where appropriate.~~

Existing paragraph 3.1.4 has been renumbered 3.3.3.

~~3.1.5 Permissible stresses for direct calculations are to be in accordance with *Pt 4, Ch 5, 2 Permissible stresses*.~~

Existing paragraph 3.1.6 has been renumbered 3.3.4.

~~3.1.7 The turret structure, including structural supports in way of bearings and highly stressed structural elements of mooring line attachments, chain stoppers and supporting structures, are to be assessed for local strength as required in Part 10 and for fatigue damage due to cyclic loading in accordance with *Pt 4, Ch 5, 5 Fatigue design*.~~

Existing paragraphs 3.1.8 and 3.1.9 have been renumbered 3.3.8 and 3.3.7.

~~3.1.10 The scantlings of the circumturret well bulkheads, turret support arrangements and hull backup structure are to be in accordance with *Pt 10 SHIP UNITS*.~~

Existing paragraphs 3.1.11, 3.1.12 and 3.11.13 have been renumbered 3.3.11, 3.3.9 and 3.3.10.

3.2 Plans and data submission

3.2.1 In addition to *Pt 3, Ch 13, 1.8 Plans and data submission 1.8.2*, strength and fatigue calculations and plans are required to be submitted for approval for the following parts, as applicable to the type of turret:

(a) Turret buoys:
- Access arrangements/attachments for means of access for inspection/maintenance purposes.
- Buoyancy cone.
- Compartment cylinder.
- Hang-offs for risers and umbilicals.
- Locking mechanism between buoyancy cone and mating cone structure.
- Mating cone seal plug.
- Mating cone structure.
- Mooring lugs.
- Turret structure.

(b) Internal turrets:
- Access arrangements/attachments for means of access for inspection/maintenance purposes.
- Bogie or bearing support structure.
- Chain connectors.
- Chain table.
- Collar structure.
- Gantry structure.

- Interface with risers and umbilicals.
- Locking mechanism.
- Moon pool bulkhead.
- Supports for manifold structure and swivel stack.
- Turret structure.
- Turret castings.

(c) External turrets:

- Access arrangements/attachments for means of access for inspection/maintenance purposes.
- Bearing support structure.
- Bulkheads and structural members.
- Chain connectors.
- Chaintable.
- Gantry structure.
- Interface with risers and umbilicals.
- Shell expansion.
- Supports for manifold structure and swivel stack.

3.2.2 Materials, structural categories, welding, NDE, connections, structural details and fabrication tolerances are to comply with the requirements of *Part 4 Steel Unit Structures*.

3.3 Design considerations

3.3.1 Turret structures supporting multi-point mooring line arrangements are to be assessed for the maximum combined forces to which they may be subjected to in service. That is, the combination of the following loadings is to be investigated, for both intact and damaged conditions:

- Most unfavourable hull loading among cases detailed in *Pt 10, Ch 2 Loads and Load Combinations*.
- Maximum mooring restoring force from the multi-point mooring line arrangement, as substantiated by analyses according to *Pt 3, Ch 10*, Section *5 Design analysis*.
- Permanent and live loads including accelerations due to vessel motions and sea pressures acting on the turret. Account is to be taken of wave slamming effects, where appropriate.

3.3.2 A structural analysis using finite element method is required to verify that the strength of the turret structure is sufficient. The extent of the structural model is to be sufficient to minimise the effect of boundary conditions. Reference is hereby made to the Appendix B of the LR *ShipRight Design and Construction Procedure for Ship Units*. Permissible stresses are to be taken according to *Pt 4, Ch 5, 2 Permissable stresses*.

~~3.1.4~~ 3.3.3 When an internal turret is designed as a stiffened shell, the scantlings of plating and stiffeners are not to be less than required by Table 7.7.1 in *Pt 4, Ch 6 Local Strength* as a deep tank bulkhead, using a load head h_4 measured vertically from the point of consideration to the top of the turret well.

~~3.1.6~~ 3.3.4 The sealing arrangements, where fitted, between internal turrets and circumturret well bulkheads will be specially considered.

3.3.5 The turret structure and supporting elements in way of bearings and other highly stressed structural elements of the load path are to be assessed for local strength as required in *Pt 10, Ch 3 Scantling Requirements*. In particular, finite element analysis of attachments to the hull is to be carried out to ensure satisfactory stress distribution of the mooring loads into the hull structure. Permissible stress levels are to comply with *Pt 4, Ch 5, 2 Permissable stresses*. Fatigue damage due to the cyclic loading is to be assessed in accordance with *Pt 4, Ch 5, 5 Fatigue design*.

3.3.6 Fairleads, stoppers and highly stressed support structures in way of mooring lines shall also be assessed by finite element method, according to *Pt 3, Ch 10, 10 Swivel testing requirements*. Fatigue damage due to the cyclic loading is to be assessed in accordance with *Pt 4, Ch 5, 5 Fatigue design*.

~~3.1.9~~ 3.3.7 Special consideration is to be given in design to load transfer together with the effect of hull deformations at the interface of the turret support structure with the main hull structure.

~~3.1.8~~ 3.3.8 Suitable access arrangements are to be provided to allow inspection and maintenance of turret structural and mooring system components during service. A planned procedure for the inspection of the structure and mooring system components is to be provided, as required by *Pt 1, Ch 2, List of abbreviations*.

~~3.1.12~~ 3.3.9 The structure of hawsepipes and their supports is to be designed to withstand the imposed static and dynamic loads. Plating and framing in way of hawsepipes are to be reinforced as necessary. All relevant loads as defined in Chapter 3 are to be considered and the permissible stresses due to overall and local effects are to be in accordance with Pt 4, Ch 5,2 *Permissible stresses*.

~~3.1.13~~ 3.3.10 Hawsepipe components are to be of ample thickness and of a suitable size and arrangement to house the mooring cables efficiently. Due consideration is to be given, as far as practicable, to minimise the effects bending and chafing on the mooring cables.

~~3.1.11~~ 3.3.11 For mechanical items such as bearings and swivels *see Pt 3, Ch 13, 6 Mechanical items*.

■ *Section 6*
Mechanical items

6.3 Bearings

6.3.18 Turret bearings which carry the operating hawser load, rotating structure load and mooring load are to be designed with a safety factor of not less than 2 without destructive yielding of the bearing surfaces. Bearing mounting bolts are to be designed in accordance with recognised industry standards acceptable to LR. For high tension bolts stress corrosion cracking is to be considered (bolting with minimum yield stress above 355N/mm^2 and tensile stress above 500 N/mm^2 will be considered as high strength bolting and hardness value to be limited to 300HV for avoidance of stress corrosion cracking).

6.3.19 Swivel bearings that do not carry the hawser load are to be designed in accordance with Anti-Friction Bearing Manufacturers Association (AFBMA) Codes or other industry standards deemed appropriated by LR.

6.3.20 The swivels are to be coated on the outside with a suitable corrosion resistant coating. This coating will not be required for parts made of corrosion resistant material. The possibility of corrosion due to the presence of CO_2, O_2, or H_2S in the cargo or product fluid is to be considered in the swivel design.

6.5 Seals

6.5.5 Swivels and sections in the swivel stack in flammable and toxic services are to use seal arrangements which shall provide redundancy such that leaks can be detected before process fluid release occurs.

6.7 Swivel stack

6.7.1 ~~The swivel stack is to be designed for the maxi-mum combined operating forces, moments, internal pressures and thermal loading~~.

Cargo or product swivels are to be of steel construction with flanged or welded connections. Details of the swivel connecting stationary piping with rotating piping are to be submitted for approval. Such details are to include fixed and rotating parts details, plate thicknesses, nozzle locations and arrangement seal and bearing design, and welding. The swivel design is to consider the most adverse combination of applicable loads. At least the following loads are to be considered:

(a) Breakaway torque required for each swivel at maximum design pressure.
(b) Weight of swivel and its structural components.
(c) Dynamic loads due to vessel motion.
(d) Piping loads.
(e) Pressure loads.
(f) Thermal loads.

Pressure retaining components of the swivel are to be designed in compliance with a Recognised Industry standard deemed appropriate by LR such as the *ASME Pressure Vessel Code*. Structural components of the swivel and driving mechanism are to comply with *Part 4 Steel Unit Structures,* of these Rules as applicable or recognised National and International structural codes or standards, including those within *Pt 12, Ch 1 Recognised Codes and Standards*.

6.7.8 Electrical swivels, if installed in hazardous area, the electrical swivel is to be certified by an independent testing laboratory as suitable for installation within such an area, the amperage rating of the electrical swivels (slip rings) is to be adequate to carry the full load current of the equipment supplied.

■ *Section 10*
Swivel testing requirements

10.1 General

10.1.2 Seal designs and materials should be Type ~~Approved~~ Tested by dynamic test which simulates a number of years of service under the conditions and with exposure to fluid representative of the design condition and depressurisation. The number of years of successful service to be proven by testing should be agreed with ~~the Owner/Operator~~ LR.

10.1.3 The following tests are to be performed on each swivel; however, test procedures should be developed by the manufacturers and approved by ~~the Owner/Operator~~ LR:

(a) Hydrostatic proof test.
(b) Pressure fluctuation test.
~~(c) Rapid decompression test (Gas Swivel).~~
(~~d~~c) Cyclical loading test.

10.1.6 Rotational and oscillation tests including rest periods are to be performed at design pressure with measurements taken of starting and running torques. The rotation speed is to be one degree per second.

10.1.7 The electrical swivel is to be subject to dielectric and insulation resistance testing in accordance with IEC 60034-1.

10.1.8 A continuity test is to be performed with the electrical swivel in rotation.

■ *Section 11*
Safety Provisions for SPM

11. 1 Navigation aids

11.1.1 Obstruction lights:

(a) Obstruction lights are to be provided as prescribed by the National Authority having jurisdiction. If the SPM is located outside the territorial waters of any National Authority or if no lights are prescribed by the authority having jurisdiction, the following is to be provided as a minimum:

- One 360 degree white light visible for five miles under an atmospheric transmissivity of 0,85, flashing six times per minute, and arranged for operation at least from sunset to sunrise local time.
- It is recommended that the floating hoses be marked with winker lights.

(b) Fog signal:

- Audible fog signals are to be provided if prescribed by the National Authority having jurisdiction.

11.2 Radar reflector

11.2.1 A radar reflector is to be provided if prescribed by the National Authority having jurisdiction.

11.3 Fire-fighting equipment

11.3.1 The fire and potential explosion risks associated with the SPM are to be assessed in a 'Fire and Explosion Evaluation' (FEE). The FEE is to define the potential requirements for active and passive fire protection systems based on the determine fire risk on the SPM, *see Pt 7, Ch 3, 1.2 General 1.2.4* and *Pt 7, Ch 3, 2.4 Fire and Explosion Evaluation (FEE).*

11.4 Identification marks

11.4.1 A name or number is to be assigned to each single point mooring and is to confirm to requirements of the National Authority having jurisdiction. This name or number is to be permanently displayed on the structure and will be entered in the Register of Ships of the Society. Draft marks are to be permanently marked in at least two places.

Part 3, Chapter 15
Integrated Software Intensive Systems

■ *Section 1*
Integrated Software Intensive System – 'ISIS' notation

1.1 General

1.1.1 Integrated Software Intensive System class notation **ISIS** may be assigned where an integrated computer system in compliance with *Pt 6, Ch 1, 6 Integrated computer control - ICC* notation of the *Rules and Regulations for the Classification of Ships, July 2016*, *incorporating Notice Nos 1,2,3,4&5* provides fault tolerant control and monitoring functions for systems that are critical to safety or operational performance. Identification of the Integrated and Software Intensive Systems are to be derived using a risk assessment technique to a recognised National or International Standard, such as those detailed in ~~IEC/ ISO~~ IEC/ISO 31010 Risk Management – Risk Assessment techniques. Examples of such systems are listed but not limited to the following:-

- Propulsion and auxiliary machinery.
- Dynamic positioning systems.
- Positional mooring systems.
- Ballast systems.
- Process and utilities.
- Drilling equipment.
- Pipe-laying systems.
- Product storage and transfer systems.
- Well control system.
- Pollution control system.
- Jacking system for self-elevating unit.
- Cantilever skidding system for drilling unit.
- Power Management System (PMS).
- Zone Management Systems (ZMS) (for all equipment where applicable).

- Mud and cement management system.
- HVAC (where applicable).
- Lifting equipment/Load positioning.
- Safety/Emergency systems.
- Communication Systems.

Part 3, Chapter 16
Wind Turbine Installation and Maintenance Vessels and Liftboats

■ *Section 2*
Structure

2.3 Deckhouses and modules

2.3.2 For surface type and surface type self-elevating units, the scantlings of structural deckhouses are to comply with *Pt 3, Ch 8, 2 Scantlings of erections other than forecastles* of the ~~Rules for Ships~~ *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4,&5*. Where deck-houses support equipment loads, they are to be suitably reinforced.

2.3.3 Offshore containers are to comply with *Pt 3, Ch 4, 2.4 Offshore containers*.

~~2.3.3 The strength of containerised modules which do not form part of the main hull structure will be specially considered in association with the design loadings.~~

~~2.3.4 When containerised modules can be subjected to wave loading or protect openings leading into buoyant spaces, the scantlings are not to be less than required by 2.3.1 or 2.3.2, as applicable.~~

~~2.3.5 For column-stabilised and self-elevating units, the structural strength of the connections between containerised modules and the supporting frame or structure are to comply with the general strength requirements of *Pt 4, Ch 6, 9 Superstructures and deckhouses*, taking into account the unit's motions and marine environmental aspects. For surface type and surface type self elevating units, the scantlings of structural deckhouses are to comply with *Pt 3, Ch 8, 2 Scantlings of erections other than forecastles*of the Rules for Ships.~~

~~2.3.6 The connections of containerised modules are also to satisfy an emergency static condition with an applied horizontal force F_H in any direction as follows:~~
~~$F_h = W \sin \theta$ N (tonne f)~~
~~where~~
~~$\theta = 25^o$ for semi-submersible and surface type units~~
~~$\theta = 17^o$ for self-elevating units and surface type self-elevating units~~
~~W = weight of the modules supported in N (tonne-f)~~

~~2.3.7 In the emergency static condition, defined in 2.3.6, the permissible stress levels are to be in accordance with *Table 5.2.1 Factors of safety for the combined load cases – load case (d)* in *Pt 4, Ch 5, 2 Permissible stresses*.~~

Part 3, Chapter 17
Pipe-laying Units

■ *Section 1*
General

1.1 Application

1.1.1 The requirements of this Chapter apply to mobile offshore units, intended for pipe-laying operations, fitted with pipe-laying equipment and are additional to those applicable in other Parts of the Rules. For the purpose of these Rules, pipe-laying operations include pipe storage, handling and transfer, bevelling, welding and cutting, NDT, repair, field joint coating, laying, abandonment, recovery and pipeline pre-commissioning.

1.1.2 The requirements may also be applied to units intended for laying cables and installing risers and umbilicals, as applicable.

1.1.3 Pipe-laying column-stabilised semi-submersible units and pipe-laying twin-hull surface-type units are to be classed as mobile offshore units and are to comply with the relevant Parts of these Rules.

1.1.4 Pipe-laying barges and ships may be optionally classed as mobile offshore units, in which case they are to comply with the relevant Parts of these Rules. Alternatively, pipe-laying barges and ships may be classed entirely with the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4,&5*, in which case they are not eligible for the **OU** and **OIWS** class notations. The *Rules and Regulations for the Classification of Offshore Units,July 2016 incorporating Notice No.1* provide a higher basis of design for the hull (50-year return period loads and 25-year minimum fatigue life, *see Pt 4, Ch 3, 4.1 General 4.1.4(a)* and *Pt 4, Ch 5, 5.2 Fatigue life assessment 5.2.3*) compared to the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4,&5* (20-year return period loads and no required fatigue assessment).

1.1.5 Pipe-laying units which have a diving complex on board are to have the diving installation approved in accordance with LR's *Rules and Regulations for the Construction and Classification of Submersibles and Underwater Systems, July 2016* or a recognised Standard acceptable to LR.

1.1.6 Classification of the unit will cease to be valid if a significant alteration is made to the pipe-laying equipment or the arrangements on board without the written approval of LR. Where it is intended at times to operate the unit with the pipe-laying equipment removed, all modes of operation with and without the pipe-laying equipment fitted are to be approved.

1.1.7 Requirements additional to those of this Chapter may be imposed by the National Authority in the country in which the unit is registered and/or Coastal State Authority under which jurisdiction the unit is to operate e.g. pipe-laying units may require compliance with *The International Code of Safety for Special Purpose Ships (SPS Code)* supplemented by the stability requirements of the 2009 MODU Code.

1.2 Class notations

1.2.1 Mobile offshore units complying with the requirements of this Chapter and the relevant Parts of these Rules will be eligible for the assignment of the **Pipe-laying unit** class type notation.

1.2.2 Support units may be assigned additional class type notations when appropriate, *see Pt 3, Ch 4, 1.2 Class notations*.

1.2.3 LR classed pipe-laying systems that have been constructed, installed and tested under LR's Special Survey and in accordance with LR's *Code for Lifting Appliances in a Marine Environment, July 2016, incorporating Notice Nos 1&2* (as applicable) will be eligible for the special features pipe-laying system class notation **PLS**. When a **PLS** notation is not assigned to a unit fitted with a pipe-laying system, classification of the unit will be subject to the pipe-laying system being certified by LR.

1.2.4 Pipe-laying units which have preventive measures to protect personnel from the hazards of dropped objects in accordance with *Pt 3, Ch 7, 10 Risks to personnel from dropped objects* will be eligible for the special features class notation **DROPS**.

1.2.5 Dynamic positioning systems for pipe-laying units are to comply with the requirements of *Pt 3, Ch 9 Dynamic Positioning Systems* and will be eligible for the **DP(AA)** or **DP(AAA)** class notation.

1.3 Scope

1.3.1 The following additional topics applicable to the class type notation are covered by this Chapter:
- Structural arrangements of the unit related to pipe-laying operations.
- Supporting structures for pipe-laying equipment, associated structures and offshore containers.
- Areas for pipe-laying operations and pipe-storage.
- Structural arrangements in way of moon pools.
- Integral tanks for the bulk storage of liquid chemicals.
- Hazardous areas and ventilation.
- Pollution prevention.

1.4 Installation layout and safety

1.4.1 In principle, pipe-laying units are to be divided into main functional areas to ensure that the following areas are separated and protected from each other:
(a) Areas for pipe-laying operations and pipe-storage, *see Pt 3, Ch 17, 1.1 Application 1.1.1*.
(b) Areas for main and auxiliary machinery, *see Part 5 Main and Auxiliary Machinery*.
(c) Living quarters area.

1.4.2 Attention is to be given to the relevant Statutory Regulations for fire safety of the National Administration in the country of registration and the areas of operation as applicable, *see Pt 1, Ch 2, 1 Conditions for classification* and *Pt 7, Ch 3 Fire Safety*.

1.4.3 Additional requirements for safety systems and hazardous areas are given in *Part 7 Safety Systems, Hazardous Areas and Fire*.

1.4.4 Living quarters, lifeboats and other evacuation equipment are to be located in non-hazardous areas and be protected and separated from the areas for pipe-laying operations and pipe-storage.

1.5 Plans and data submission

1.5.1 Plans, calculations and data are to be submitted as required by the relevant Parts of the Rules together with the additional plans and information listed in this Chapter.

■ *Section 2*
Structure

2.1 Plans and data submission

2.1.1 In addition to the structural plans and information as required by *Pt 3,Ch 1, 2 Information required* and *Pt 4, Ch 1, 4 Information required*, additional plans are to be submitted showing structure in way of and supporting:

(a) abandonment and recovery systems and arrangements, including winches, fairleads and sheaves for abandonment and recovery wire routing;
(b) basket and reel carousels;
(c) hang-off arrangements;
(d) heavy lift cranes and other lifting appliances;
(e) mooring attachments for attending pipe-carrier vessels/tender barges and supply vessels;
(f) pipe-handling/transfer systems;
(g) pipe-lay towers and ramps;
(h) pipe storage equipment, arrangements and areas;
(i) roller boxes
(j) systems handling in-line and pipeline end termination or manifold structure;
(k) stinger and stinger handling frames;
(l) stations for pipe bevelling, welding, NDT, repair and field joint coating;
(m) winches and tensioners; and
(n) other pipe-laying equipment not listed in the above.

2.1.2 The general arrangement plan of the unit is to include the locations of the following:

(a) The structures and equipment mentioned in *Pt 3, Ch 17 2.1 Plans and data submission 2.1.1*.
(b) Hatches and other openings to enclosed spaces for pipe-laying operations and adjacent cofferdams, where fitted.
(c) Doors, hatches, ventilation and other openings to crew accommodation, control stations, stations for pipe-laying operations, store rooms and workshops.
(d) Coated tanks or tanks constructed of materials other than carbon steel.

2.2 General

2.2.1 The general hull strength is to comply with the requirements of *Part 4 Steel Unit Structures*, taking into account the applied weights and forces due to the accommodation, cranes, and structures and equipment mentioned in *Pt 3, Ch 17 2.1 Plans and data submission 2.1.1*. The local structure is to be suitably reinforced. Attention should be paid to loads resulting from hull flexural effects at support points.

2.2.2 The design loadings for the strength of areas for pipe-laying operations, pipe-storage and hull sub-structure are to be defined by the designers/Builders, and calculations are to be submitted.

2.2.3 The primary hull strength of the unit is to be maintained in way of moonpools and other large openings, and suitable compensation is to be fitted as necessary. In general, the design should be such that the bulkheads are connected to bottom and deck girders by means of large, suitably shaped brackets arranged to give a good stress flow at their junctions with both the girders and bulkheads. The boundary bulkheads of moonpools are to be designed for the maximum forces imposed on the structure.

2.2.4 For surface type units, the continuity of longitudinal material is to be maintained, as far as is practicable, in way of moonpools and openings, and the minimum hull modulus is to satisfy the Rule requirements for longitudinal strength.

2.2.5 The structural design of integral tanks for the bulk storage of liquid chemicals, e.g. for field joint coating, is to comply with the requirements in this Part outlined for cargo tanks and other tanks designed for liquid filling. The following requirements are also to be complied with:

(a) For strength assessments, the density is to be taken as the greater of 1,025 t/m^3 and the maximum for the liquid chemicals to be stored in the tank. For fatigue assessments, the density is to be taken as the mean of the liquid chemicals stored in the tank.
(b) Consideration is to be given to the nature of the chemicals being stored, including their corrosiveness, reactivity and flammability. Arrangements are in general to comply with the *International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code - International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk Amended by Resolution MEPC.225(64))*, as interpreted by LR.

(c) Corrosion rates will be specially considered on the basis of the corrosiveness and reactivity of the stored chemical with the tank material.

2.3 Materials

2.3.1 Support structures for the structures and equipment mentioned in *Pt 3, Ch 17, 2.1 Plans and data submission 2.1.1* are to be divided into the following categories defined in *Pt 4, Ch 2, 2 General 2.1.2*:

- Special structure.
- Primary structure.
- Secondary structure.

2.4 Offshore containers

2.4.1 Offshore containers (including portable tanks for the storage of pipeline pre-commissioning chemicals) are to comply with *Pt 3, Ch 4, 2.4 Offshore containers*.

■ *Section 3*
Hazardous areas and ventilation

3.1 Hazardous areas and ventilation

3.1.1 For the application of hazardous area classification and ventilation requirements for pipe-laying units, *see Pt 7, Ch 2 Hazardous Areas and Ventilation*.

3.1.2 Ventilation in the vicinity of chemical tanks, pipe welding (*see also Pt 3, Ch 17, 5.3 Consumables for welding pipes*) and field joint coating areas is to be specially considered to ensure adequate dilution of any dangerous gases.

■ *Section 4*
Pollution prevention

4.1 General

4.1.1 Where chemicals for pipeline pre-commissioning and field joint coating are stored/used on board, provision is to be made to limit their spread on the unit as far as practicable, and to prevent the discharge of chemicals or chemical residues into the sea.

4.1.2 Equipment requiring maintenance is to have adequate spillage catchment arrangements.

4.1.3 Pollution prevention arrangements should be such that the unit can comply with the requirements of the relevant National Administrations in the country of registration and in the area of operation, as applicable.

■ *Section 5*
Pipe-laying System

5.1 General

5.1.1 Pipe-laying systems are to be designed, constructed, installed, tested and surveyed in accordance with LR's *Code for Lifting Appliances in a Marine Environment, July 2016, incorporating Notice Nos 1&2* (as applicable).

5.2 Documentation, plans and data submission

5.2.1 A description of the pipe-laying operations including a diagram showing the process flow is to be submitted.

5.2.2 A list of consumables/chemicals to be stored/used on board in the pipe-laying operations is to be submitted.

5.2.3 Particulars of the proposed storage arrangements of hazardous and/or toxic substances and products in bulk are to be submitted.

5.2.4 Details of personnel protection equipment related to pipe-laying operations, its location and the National or International Standard(s) to which it is compliant with, e.g. tinted goggles for eye protection to BS EN 169, are to be provided.

5.2.5 Particulars of any proposed storage arrangements for radioactive isotopes (if used in pipe-lay NDT operations) are to be submitted.

5.2.6 Particulars of the proposed NDT station operations are to be submitted, with particular regard to the protection of personnel if ionising radiation is to be used, either x-rays or gamma-rays (i.e. radiography operations).

5.3 Compressed gas consumables for welding and cutting

5.3.1 Portable gas cylinders and other pressure vessels used to transport and store liquids or gases under pressure, e.g. acetylene and oxygen, are to comply with an acceptable National or International Standard, *see also Pt 12, Ch 1, 8 Compressed gas utility systems.*

5.3.2 Means are to be provided to secure portable gas cylinders at all times.

5.3.3 Portable gas cylinders are to be stored in accordance with Chapter 9.17 of the 2009 MODU Code - Code for the Construction and Equipment of Mobile Offshore Drilling Units. Portable gas cylinders are to be stored in a well-ventilated area. The storage area should be located away from sources of heat, sparks and fire risk. Cylinders should be stored upright and well secured.

5.3.4 Oxygen cylinders are to be stored in an area free from combustible material. When stored in open locations, oxygen and fuel gas (e.g. acetylene/propane) cylinders are to be stored in separate open locations. Where two or more cylinders of oxygen or fuel gas are intended to be carried in enclosed spaces, separate dedicated storage rooms should be provided for oxygen cylinders and fuel gas cylinders, with the storage rooms constructed of steel. Provision should be made for the expeditious removal of cylinders in the event of fire.

5.3.5 Further guidance, which should be consulted, is given in Chapter 9.17 of the 2009 MODU Code - Code for the Construction and Equipment of Mobile Offshore Drilling Units and also the following documents from the British Compressed Gas Association (BCGA):

- BCGA *Guidance Note 2 Guidance for the storage of gas cylinders in the workplace*
- BCGA *Code of practice CP7 The safe use of oxy-fuel gas equipment (individual portable or mobile cylinder supply)*
- BCGA *Guidance Note GN11 Reduced oxygen atmospheres.*

■ *Section 6*
Safety systems, hazardous area and fire

6.1 General

6.1.1 Safety systems, hazardous areas and fire safety requirements are to be in accordance with the requirements of Pt 7 Safety Systems, Hazardous Areas and Fire, and are to be complied with as applicable.

6.1.2 The gas generation, storage and distribution systems for welding and cutting are to be included in the unit's 'Fire and Explosion Evaluation' (FEE) report, *see Pt 7, Ch 3, 2.4 Fire and Explosion Evaluation (FEE)*. For welding and cutting stations, reference is to be made to NFPA 51 *Standard for the Design and Installation of Oxygen - Fuel Gas Systems for Welding, Cutting, and Allied Processes*. For acetylene and oxygen gas generation plants, reference is to be made to NFPA 55 *Compressed Gases and Cryogenic Fluids Code*.

Part 3, Appendix A
~~Codes, Standards and~~ Equipment Categories

■ ~~*Section 1*~~
~~Codes and Standards~~

Has been deleted in its entirety, restructured with content amendment and relocated to the newly added Part 12, Chapter 1.

■ *Section ~~2~~1*
Equipment categories

The complete contents of this Section have been renumbered.

Part 4, Chapter 1
General

■ *Section 4*
Information required

4.2 Plans and supporting information

(*Part only shown*)

4.2.2 The following supporting plans and documents are to be submitted:

- General arrangement showing moorings for tandem and side by side offloading. This is to include the maximum and minimum dimensions and main particulars for the range of shuttle tankers that are permitted to attend. For each mooring line, the breaking load and the maximum and minimum angles (horizontal and vertical) between the line and the offshore unit are to be stated.

Part 4, Chapter 2
Materials

■ *Section 2*
Structural categories

2.2 Column-stabilised and tension-leg units

(*Part only shown*)

2.2.1 In general, the structural members of column-stabilised and tension-leg units are to be grouped into the following structural categories:

(b) **Primary structure:**

(i) The plating of decks, heavy flanges, shell boundaries and bulkheads of the upper hull or platform which form 'box' or '**I**' type supporting structure except where the structure is considered as special application.

(ii) The shell plating of vertical columns, lower and upper hulls, and diagonal and horizontal braces.

(iii) Bulkheads, flats or decks, stiffeners and girders which provide local reinforcement or continuity of structure in way of intersections, except areas where the structure is considered as special application.

(iv) Main support structure to cantilevered helicopter decks and lifeboat platforms.

(v) Heavy substructures and equipment supports, e.g., drillfloor substructure, crane pedestals, anchor line fairleads and their supporting structure, *see also Pt 4, Ch 2, 2.1 General 2.1.3*.

(vi) Riser support structure.

(vii) Bulkhead plating in way of moonpools and drilling wells.

2.3 Self-elevating units

(*Part only shown*)

2.3.1 In general, the structural members of self-elevating units are to be grouped into the following categories:

(b) **Primary structure:**

(i) The plating of bulkheads, decks and shell boundaries of the main hull or platform which in combination form 'box' or '**I**' type main supporting structure.

(ii) External plating of cylindrical legs.

(iii) Plating of all components of lattice type legs.

(iv) Jack-house supporting structure.

(v) External shell plating of footings and mats and structural components which receive initial transfer of loads from the leg structures.

(vi) Internal bulkheads and girders of supporting structure of footings and mats which are designed to distribute major concentrated or uniform loads into the structure.

(vii) Main support structure to cantilevered helicopter decks and lifeboat platforms.

(viii) Heavy substructures and equipment supports, e.g., drillfloor substructure, drilling cantilevers, supports for raw water towers and crane pedestals, *see also Pt 4, Ch 2, 2.1 General 2.1.3*.

(ix) Towing brackets.

(x) Bulkhead plating in way of moonpools and drilling wells.

Part 4, Chapter 3
Structural Design

■ *Section 7*
Corrosion additions

7.4 Scantling compliance

(*Part only shown*)

Table 3.7.1 Corrosion rate for one side of structural member

Compartment type	Structural member	Corrosion rate t_{c1}, t_{c2} (mm/year)
Cargo oil tank	within 3m below top of tank, *see* Note 1	0,125
	Bottom of ~~single bottom~~ tanks	0,125
	Elsewhere	0,075

Part 4, Chapter 4
Structural Unit Types

■ *Section 1*
Column-stabilised units

1.10 Topside structure

1.10.6 Units with a pipe-laying system which comply with the class requirements of *Pt 3, Ch 17 Pipe-laying Units* will be eligible for the assignment of the special features class notation **PLS**.

■ *Section 4*
Surface type units

4.2 Surface type units for drilling, pipe-laying and support activities

4.2.3 **Drilling well/Moonpool**. The hull structure in way of the drilling well/moonpool is to be suitably strengthened so as to ensure continuity of the required longitudinal strength.

Part 4, Chapter 5
Primary Hull Strength

■ *Section 5*
Fatigue design

5.2 Fatigue life assessment

(*Part only shown*)

5.2.1 Fatigue life assessment of all relevant structural elements is required to demonstrate that structural connections have a fatigue endurance consistent with the planned life of the unit and compliance with the minimum requirements. The following structural elements are to be included:

(e) General: Hull, deck and supporting structure in way of topside facilities, e.g:

- Module support.
- Process plant support stools.
- Crane pedestal.
- Flare structures.
- Offloading station.

- Drilling derrick and substructures.
- Structure supporting pipe-laying systems.

Part 4, Chapter 6
Local Strength

■ *Section 1*
General requirements

1.1 General

1.1.16 Where a pipe-laying system is installed, the structures and equipment mentioned in *Pt 3, Ch 17, 2.1 Plans and data submission 2.1.1* are to be integrated into the unit's hull structure. The integration structure of the hull is a classification item and its local permissible stresses are to comply with *Pt 4, Ch 5 Primary Hull Strength*.

■ *Section 4*
Decks

4.1 General

4.1.6 For units fitted with a pipe-laying system, process plant facility and/or drilling equipment, the support stools and integrated hull support structure to the pipe-laying system, process plant and other equipment supporting structures to drilling derricks and flare structures, etc.~~,~~ are considered to be classification items regardless of whether or not the pipe-laying system, process/drilling plant facility is classed and the loadings are to be determined in accordance with *Pt 3, Ch 8, 2 Structure*. Permissible stress levels are to comply with *Pt 4, Ch 5 Primary Hull Strength*.

4.4 Deck supporting structure

(*Part only shown*)

Table 6.4.3 Deck girders, transverses and deep beams

Location and arrangements	Modulus, in cm^3
(3) Girders and transverses in way of the crown or bottom of tanks	$Z = ~~9,6~~ 6,3\rho k h_4 S l_e^2$

■ *Section 7*
Bulkheads

7.3 Watertight and deep tank bulkheads

(*Part only shown*)

Table 6.7.1 Watertight and deep tank bulkhead scantlings

Item and requirement	Deep tank bulkheads
(5) Stringers or webs supporting vertical or horizontal stiffening (a) Modulus	$Z = ~~9,6~~ 6,3\rho k h_4 S l_e^2 cm^3$

Part 4, Chapter 8
Welding and structural details

■ *Section 6*
Fabrication tolerances

6.1 General

6.1.2 For cylindrical members, the out of roundness is not to exceed 0,5 per cent of the true mean radius ~~or 25 mm of the true mean internal diameter, whichever is the lesser~~. Applicability of absolute out of roundness tolerances to structures with large diameter to wall thickness ratios (D/t>300) will be specially considered e.g. circumturret bulkhead.

Part 5, Chapter 12
Piping Design Requirements

■ *Section 1*
General

1.1 Application

1.1.2 Additional requirements in this Chapter should also be complied with, as applicable.

■ *Section 2*
Expansion pieces

2.1 General

2.1.1 The design and construction of expansion pieces intended for installation in piping systems is to be in accordance with an acceptable standard or design code appropriate to the piping system. Where suitable standards are not available, details of materials and construction are to be submitted for consideration.

2.1.2 The design of expansion pieces is to take account of pressure, temperature, fluid compatibility, loads to accommodate axial and lateral movements and fatigue life due to vibration.

2.1.3 Prototype pressure tests are to be carried out on each new type of expansion piece, and in no case is the burst pressure to be less than four times the design pressure.

2.1.4 For requirements relating to testing after manufacture, *see Pt 5, Ch 12, Section 8 Hydraulic tests on pipes and fittings* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5*.

2.1.5 Expansion pieces are only to be used in permanent piping system installations to accommodate axial and lateral movements. They are not to be used to compensate for piping misalignment unless specifically designed for the purpose.

2.1.6 Expansion pieces are to be used within their specified pressure, temperature and movement conditions for all normal operating conditions. The design and operating ratings of expansion pieces are not to be less than that of the piping system in which the expansion piece is installed.

2.1.7 Expansion pieces used in compressed air, boiler feed water and steam piping systems are to be of steel or other approved material.

2.1.8 Expansion pieces incorporating oil resistant rubber or other suitable synthetic material may be used in cooling water lines in machinery spaces. Where fitted in sea water lines, they are to be provided with guards which effectively enclose, but do not interfere with, the action of the expansion pieces and will reduce to a minimum practicable, any flow of water into the machinery spaces in the event of failure of the flexible elements. Proposals to use such fittings in water lines in other services will be specially considered when plans of the piping systems are submitted for approval.

2.1.9 Expansion pieces are to be installed in accordance with the manufacturer's instructions and are to be protected against over extension and over compression. The adjoining pipes are to be suitably aligned, supported and anchored. Where necessary, expansion pieces of bellows are to be protected against mechanical damage.

2.1.10 All moving parts are to be provided with guards to minimise danger to personnel.

Part 5, Chapter 24
Fresh Water Systems

■ *Section 1*
General requirements

1.1 Definitions

1.1.1 For the purpose of this Chapter, the following definitions apply:

(a) **Fresh water** – Water that is not salty and is used on board offshore units. Fresh water may be supplied to the offshore unit or be produced on board by the desalination of sea water. The density of fresh water is to be taken as 1000 kg/m^3.

(b) **Potable water** – Drinkable water that meets the water quality defined in the World Health Organisation's *Guidelines for Drinking Water Quality* and is designated for drinking, domestic services and food preparation. Potable water is obtained by the sterilisation of fresh water.

1.2 Goal

1.2.1 The goal of this Chapter is to provide requirements for the design, construction and inspection of sea water desalination plants and fresh water systems installed in offshore units in order to minimise the risks to the asset, environment and persons on board resulting from fresh water which does not meet its required quality, insufficient supply of fresh water, foreign matter in the fresh water system and inadequately designed sea water desalination plants and fresh water systems.

1.3 Application

1.3.1 This Chapter is applicable to sea water desalination plants and fresh water systems installed in offshore units. Examples of fresh water systems are, but are not limited to:
(a) Water systems for potable water.
(b) Cooling water systems.
(c) Chilled water systems for air conditioning.
(d) Window washing systems.
(e) Life safety systems including emergency eyewash, emergency facewash and emergency shower systems.

1.3.2 Compliance with this Chapter does not guarantee compliance with statutory requirements concerning fresh water of any National Authority/Coastal State Authority.

1.3.3 Offshore units with an installed fresh water system (including sea water desalination plant, if fitted) which complies with this Chapter and *Pt 1, Ch 3, 2.8 Sea Water Desalination Plants and Fresh Water Systems* will be eligible for the assignment of the class notation **FWS** (Fresh Water System). Where an installed fresh water system for potable water is compliant with this Chapter, a descriptive note **Potable Water System** may be entered on the *Class Direct* website. Where an installed sea water desalination plant is compliant with this Chapter, a descriptive note **Sea Water Desalination Plant** may be entered on the Class Direct website.

1.3.4 A risk assessment in accordance with a recognised National or International Standard, such as those detailed in IEC/ISO 31010 *Risk Management - Risk Assessment techniques*, is required to justify dispensations from this Chapter, *see also Pt 3 Ch 15, 1.1 General* for the use of a risk assessment to identify safety critical systems.

1.3.5 The requirements of this Chapter supplement the requirements of ISO 15748-1 *Ships and marine technology – Potable water supply on ships and marine structures. Part 1: Planning and design*. In addition to the requirements in this Chapter, fresh water systems for potable water are to comply with ISO 15748-1.

1.3.6 Guidance on the design of potable water systems is given in *Water Report 129 – Safe, Sufficient and Good Potable Water Offshore* by the Norwegian Institute of Public Health and *Guide to Ship Sanitation* by the World Health Organisation.

1.4 Documentation required for design review

1.4.1 The following plans (in diagrammatic form, where applicable) and information for the fresh water system are to be submitted in addition to those required by *Pt 5, Ch 13, 1.3 Plans and particulars* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5*:
(a) Piping arrangements.
(b) Major component parts, pipe sizes, system flow rates and pressures.
(c) Capacities of pumps and plants.
(d) Arrangements of alarms, control systems and safeguards.
(e) Arrangements of electrical systems including power supplies.
(f) Fresh water storage tanks.
(g) Segregation and access arrangements for compartments and associated control rooms/stations.
(h) Arrangements and structure of compartments used and intersected by the fresh water system.
(i) Arrangements for desalination, if fitted.
(j) Arrangements for the monitoring and quality control of fresh water production.

1.4.2 The following documents are to be submitted for approval.

(a) **Fresh Water System Design Description**
This is a document that describes the design of the fresh water system. The Fresh Water System Design Description details the system's capability and functionality under all normal and reasonably foreseeable abnormal operating and fault conditions. The System Design Description documents are to be agreed between the designer and the Owner. LR may accept alternative documents where these provide the information which would be included within the Fresh Water System Design Description. In such cases the relevant sections providing the information required to provide equivalence with the Fresh Water System Design Description are to be identified.
(b) **Testing and trials procedures**
These are procedures detailing a schedule of testing and trials to demonstrate that systems are capable of operating as described in *Pt 5, Ch 24, Section 3 System arrangements* and as required by *Pt 5, Ch 24, Section 5 Testing and trials*.
(c) **Coating Specification and Certificates**

Specifications of coatings in contact with fresh water, including certificates for the testing of toxicity and tainting of coatings in contact with fresh water by an independent laboratory

(d) **Specifications of Materials**
Specifications of metallic and non-metallic materials in contact with fresh water.

1.4.3 Operating manuals for sea water desalination plant, if fitted, and fresh water systems are to be provided on board and submitted for information where requested by LR. The manuals are to include the following information:

(a) Particulars and a description of the systems for the sea water desalination and storage and distribution of fresh water. The particulars are to include system arrangement plans showing each mode of operation of each system.
(b) Operating arrangements for each mode of operation for the equipment and systems installed.
(c) Cleaning arrangements and any precautions required for the use, storage and disposal of any recommended chemicals used for cleaning systems and equipment.
(d) Coating and maintenance instructions for fresh water storage tanks.
(e) Cleaning instructions for filters, calorifiers and other equipment where bacteria may accumulate in fresh water systems.
(f) Maintenance instructions and fault finding procedures for the equipment and systems.
(g) Preservation procedure for short and long term periods laid up or out of service, as applicable. *See also Pt 1, Ch 2, 3.5 Existing installations – Periodical Surveys 3.5.27*.

1.4.4 Calculations for the personal daily allowance of potable water and the required storage capacities for potable and other fresh water are to be submitted for review, *see Pt 5, Ch 24, 3.1 Water storage facilities 3.1.1*.

■ *Section 2*
Equipment and components

2.1 Materials

2.1.1 Pipes, valves and fittings are, in general, to be made of steel, ductile cast iron, copper, copper alloy, or other approved ductile material suitable for the intended purpose. The use of plastics materials is also acceptable subject to any restrictions in *Pt 5, Ch 12 Piping Design Requirements* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5*.

2.1.2 Where applicable, the materials are to comply with the requirements of *Pt 5, Ch 12 Piping Design Requirements* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5*.

2.1.3 The selection of materials in piping systems is to recognise the following details:

(a) Fluid properties, pressures and temperatures.
(b) Location and configuration.
(c) Compatibility of materials.
(d) Fluid flow rates and static conditions.
(e) Minimising corrosion and erosion through life of system.
(f) System survey, cleaning and maintenance requirements.

See Pt 5, Ch 12, Section 11 Appendix - Guidance notes on metal pipes for water services of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5* for guidance notes on metal pipes for water services.

2.1.4 Materials for fresh water systems for potable water are to be of types that do not provide a habitat for bacteria which can occur with natural rubber, various plastics and fibre accessories, and do not leach out toxic constituents, *see also* ISO 15748-1.

2.2 Pipe wall thickness

2.2.1 The minimum nominal wall thickness of steel, copper and copper alloy pipes are to be in accordance with *Pt 5, Ch 12 Piping Design Requirements* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5*.

2.2.2 Special consideration will be given to the wall thickness of pipes made of materials other than steel, copper and copper alloy.

2.3 Piping and equipment

2.3.1 Pressurised tanks are to be in accordance with the requirements of *Pt 5, Ch 11 Other Pressure Vessels* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5*.

2.3.2 Valves, flexible hoses, expansion pieces and pumps are to comply with *Pt 5, Ch 24, 2.1 Materials* and the following requirements:

(a) Valves - *Pt 5, Ch 12, Section 6 Valves* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5*.
(b) Flexible hoses - *Pt 5, Ch 12, Section 7 Flexible hoses* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5*.
(c) Expansion pieces - *Pt 5, Ch 12, 2 Expansion pieces*.
(d) Pumps - *Pt 5, Ch 24, 2.6 Pumps*.

2.3.3 The configuration of piping systems is to be arranged to minimise erosion and corrosion of pipe and equipment materials. Equipment used in fresh water systems and piping systems is to be suitable for its intended purpose, and accordingly, wherever practicable, be selected from LR's *List of Type Approved Products*.

2.3.4 Pipes in piping systems are to be permanent pipes made with approved pipe connections to enable ready removal of valves, pumps, fittings and equipment. The pipes are to be efficiently secured in position to prevent chafing or lateral movement.

2.3.5 Suitable means for expansion is to be made, where necessary, in the piping system.

2.3.6 Efficient protection is to be provided for all pipes situated where they are liable to mechanical damage.

2.4 Valves and bursting disks

2.4.1 Valves are to be fitted in places where they are readily accessible at all times.

2.4.2 All valves that are provided with remote control arrangements are to be arranged for local manual operation, independent of the remote operating mechanism. The local manual means of operation is to be readily accessible.

2.4.3 Relief valves are to be adjusted and bursting disks selected so that they relieve at a pressure not greater than the design pressure of the system. When satisfactorily adjusted, relief valves are to be protected against tampering or interference by wire with a lead seal or similar arrangement.

2.5 Expansion pieces

2.5.1 The design and construction of expansion pieces intended for installation in piping systems is to be in accordance with *Pt 5, Ch 12, 2 Expansion pieces*.

2.6 Pumps

2.6.1 Pumps are to be capable of operating satisfactorily under the conditions shown in *Pt 5, Ch 1, 2 Operating conditions*. The selection of pumps is to consider:

(a) Pump characteristic and required duty.
(b) Performance if required to perform a secondary duty.
(c) Pumped fluid and its temperature ranges.
(d) Maximum discharge pressure head from the pump and design pressure of piping system.
(e) The size of air pipes and capacity of air pipe heads fitted to tanks which can be pumped up.
(f) The need to fit relief devices to pumps and piping systems.
(g) Maximum permissible fluid velocities in the piping system to avoid erosion and damage to valve seats and other fittings.
(h) Minimum fluid velocities to avoid fouling and subsequent pitting.

2.7 Cathodic protection

2.7.1 Sacrificial anode cathodic protection is not permitted in fresh water storage tanks.

2.8 Coating of storage tanks and piping internal surfaces

2.8.1 Storage tanks, piping and valves constructed from carbon and low alloy steels and cast irons are to be lined internally with a corrosion control coating suitable for the containment and transfer of fresh water.

2.8.2 Corrosion control coatings are to be tested and certified as complying with standards specified by the designer and Owner.

2.9 Plastic piping and flexible hoses

2.9.1 Plastic piping which is internally uncoated may be used in piping systems for fresh water, subject to compliance with;

- *Pt 5, Ch 12, 5 Plastic pipes* of the *Rules and Regulations for the Classification of Ships, July 2017.*
- *Pt 5, Ch 12, 7 Flexible hose* of the *Rules and Regulations for the Classification of Ships, July 2017.*
- and the relevant Sections of *Pt 5, Ch 13, Ship Piping Systems* of the *Rules and Regulations for the Classification of Ships, July 2017.*

2.9.2 Any internally uncoated plastic piping or flexible hose in contact with fresh water is to be suitable for the containment and transfer of fresh water in accordance with a recognised National or International Standard e.g. BS 6920-1 *Suitability of non-metallic materials and products for use in contact with water intended for human consumption with regard to their effect on the quality of the water*.

2.9.3 Uncoated plastics piping and flexible hoses are to be tested and certified as complying with current standards for use in fresh water systems.

2.9.4 Plastic piping is to be selected in consultation with the manufacturers with regard to suitability with the proposed pipe system cleaning practice.

2.10 Direct steam water calorifiers

2.10.1 Steam used directly to heat potable water, e.g. in direct steam injection heaters, is to be suitable for potable use.

2.10.2 Feedwater and boiler water in a boiler supplying steam to heat potable water are to be treated in accordance with a recognised National or International Standard e.g. BS 2486 *Recommendations for treatment of water for steam boilers and water heaters* and BS EN 12953-10 *Shell boilers. Requirements for feedwater and boiler water quality*.

2.10.3 All chemicals used to treat the boiler feed water e.g. to inhibit scale formation, corrosion, freezing and sludge in a boiler supplying steam to heat potable water are to be approved for use with potable water in accordance with a recognised National or International Standard e.g. NSF/ANSI 60 - *Drinking Water Treatment Chemicals – Health Effects*.

2.10.4 Filling pipes used for adding chemicals are to have close-fitting caps to prevent ingress of a contaminant/foreign matter.

■ *Section 3*
System arrangements

3.1 Water storage facilities

3.1.1 Sufficient potable water storage is to be provided to cater for the needs of the persons on board. A personal daily allowance of potable water and the required storage capacities for potable and other fresh water are to be calculated and the calculations are to be submitted for review (*see* ISO ISO 15748-2 for guidance on calculations); these are to be based on:

(a) The equipment fitted on-board and their flow rate demands e.g. types of shower heads, toilets (flush or vacuum), washing machines and dishwashers.
(b) The operational philosophy for the use of fresh water e.g. the number, time of day and duration of showers, laundry and catering operations, and any rationing of water.
(c) The operational philosophy for the generation of fresh water i.e. continuous or periodic.
(d) The rates of fresh water generation including the rates of desalination and sterilisation, and any downtime for inspection and maintenance of the sea water desalination plant.

Storage capacities are to take into account both average and peak loadings, the latter of which may be typically three times the normal usage rate. The personal daily allowance is not to be taken as less than that required by National Authority Regulations, where such a requirement exists.

Note
National Authority Regulations may stipulate a minimum water storage capacity e.g. the Norwegian Potable Water Regulations require potable water systems to be dimensioned for a consumption of at least 200 litres of potable water per person per day.

3.1.2 At least two storage tanks are to be fitted, each with separate means of supplying on-specification fresh water to the distribution main. The tanks are to be sited and be of such dimensions that they are readily accessible to facilitate inspection, cleaning and coating.

3.1.3 The internal structure of fresh water tanks is to be designed to ensure efficient drainage to the suction point. Transfer pump suctions for potable water tanks are to be placed higher than drain connections in order to avoid tank sediment from entering the piping system. Fresh water tanks are not to have a common boundary with another tank that can contain oil or any other liquid except fresh water ballast. Access arrangements to storage tanks are to be arranged and sited clear of sources of possible contamination. Storage tanks and manholes are to be designed to facilitate inspection and cleaning of the tanks while the offshore unit is in operation.

3.1.4 Pipes other than piping containing fresh water of the same quality as the tank contents are not to pass through or be located within a fresh water tank. Pipes carrying fresh water are not to pass through tanks other than fresh water tanks.

3.1.5 The storage facilities for potable water are to be independent of fresh water systems for other uses e.g. boiler feed services. The storage and piping arrangements are to comply with *Pt 5, Ch 14, 6 Boiler feed water, condensate and thermal fluid circulation systems* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice No. 1,2,3,4& 5*.

3.1.6 Water storage tanks are to be provided with means of indicating the water level. The means of routine level inspection is to be by means other than those that require breach of the tank containment such as sounding rods or similar.

3.1.7 Air and filling arrangements for fresh water storage tanks are to be located and arranged to prevent ingress of a contaminant/foreign matter. The arrangements for filling are to include a deck connection to facilitate external loading.

3.1.8 The local strength of fresh water tanks is to comply with *Pt 10, Ch 3 Scantling requirements* for ship units and *Pt 4, Ch 6 Inspection, workmanship and testing* for other units.

3.2 Sea Water desalination plants

3.2.1 Installed sea water desalination plants are to be capable of producing fresh water, as a minimum, to the quality defined in the World Health Organisation's *Guidelines for Drinking Water Quality*. A more stringent quality of water production may be necessary in the case of water for use in, for example, boiler feed systems. In these cases, an alternative means of fresh water production is to be provided or a further stage of desalination included in the production arrangements. Where the specified quality for fresh water is

different to that of the World Health Organisation, details to be provided to LR.

3.2.2 The capacity of the plant and tank storage is to be specified by the Owner in the *Fresh Water System Design Description*.

3.2.3 Two or more plants for desalinating water are to be provided, of sufficient combined capacity to produce sufficient water under defined levels of requirements stated in the *Fresh Water System Design Description*. Provision of single plant will be considered in conjunction with the operational requirements of the offshore unit and any assigned service restriction.

3.2.4 The design of sea water desalination plants is to be such to permit cleaning, maintenance and repair of any plant whilst the other is in service.

3.2.5 Adequate cleaning arrangements are to be fitted to sea water desalination plants. A suitable safe area is to be designated for system cleaning agents.

3.2.6 In the case of distilling type plants, adequate safeguards are to be incorporated to prevent excess steam pressure. Steam piping arrangements are to comply with *Pt 5, Ch 14, 5 Steam piping systems* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice No. 1,2,3,4& 5*.

3.2.7 Where there are low pressure evaporators using diesel engine jacket water as the heating medium, any corrosion inhibitors in the jacket water are specifically approved for that application.

3.2.8 Means are to be provided to automatically prevent off-specification fresh water from entering systems and storage. The arrangements are to minimise the risk of contamination.

3.3 Piping system design

3.3.1 Piping system arrangements are to be such that the supply of fresh water to systems such as chilled water, machinery cooling water and boiler feed water can be made in the event of a single failure or damage of a system or item of equipment. As far as possible, permanent connections to such systems are to be avoided to prevent contamination of the fresh water by additives such as corrosion inhibitors that may be present in the systems. Where it is essential to fit permanent connections, means are to be provided to isolate the systems from the fresh water supplies to ensure that cross-contamination cannot take place when the systems are operating normally.

3.3.2 The design of piping systems is to be consistent with the operational philosophy for the offshore unit and is to be declared in the *Fresh Water System Design Description*.

3.3.3 All equipment fitted in piping systems is to be readily accessible to facilitate maintenance and survey. For this purpose, valves or cocks are to be fitted between items of equipment and the inlet and outlet pipes in order that any item of equipment may be shut off for opening up and overhauling.

3.3.4 Any filter elements fitted in equipment or piping systems are to be capable of being cleaned and/or changed.

3.3.5 Pressure relief devices are to be mounted in such a way that it is not possible to isolate them from the part of the system which they are protecting except that, where duplicated, a changeover valve may be fitted that will enable either device to be isolated for maintenance purposes without it being possible to shut off the other device at the same time.

3.3.6 Shipside valves and fittings are to comply with *Pt 5, Ch 13, 2.5 Ship-side valves and fittings (other than those on scuppers and sanitary discharges)* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice No. 1,2,3,4& 5*.

3.3.7 Sea water inlets for desalination plants should be located in order to minimise the potential for ingress of polluted water e.g. from bilge and sanitary discharges from the offshore unit and cooling water inlets and outlets. In order to assess the pollution threat, the discharge dispersal area is to be determined. Sea water inlets should be located as far away from the discharge points as practicable and preferably upstream of the discharge point, considering the most common current direction.

3.3.8 Not less than two sea inlets, as far apart as practicable, are to be provided for pumps supplying sea water to the sea water desalination plant. Where these inlets are shared with other systems, e.g. ballast and sea water cooling, sea water desalination plants are to have dedicated connections with non-return valves at manifold pipes or crossover pipes.

3.3.9 Where a high pressure sea water system is installed (*see Pt 5, Ch 13 Ship Piping Systems* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice No. 1,2,3,4& 5*), provision is to be made for emergency supply to the sea water desalination plant.

3.3.10 Provision is to be made for all sea water to pass through suitable filters before being introduced to the sea water desalination plant. The filters are to be in accordance with the equipment manufacturer's recommendations.

3.3.11 Piping system arrangements and associated equipment are to be capable of operating satisfactorily under the conditions shown in *Pt 5, Ch 1, 3 Operating conditions*.

3.3.12 The system is to be capable of being cleaned, with arrangements for safely flushing out any cleaning chemical agents after use and for storing or disposing of them safely.

3.3.13 Gaskets and sealing materials in contact with fresh water are to be suitable for the containment of fresh water in accordance with a recognised National or International Standard e.g. NSF/ANSI 61 - *Drinking Water System Components - Health Effects*

3.4 Piping system distribution

3.4.1 Two or more water pumps are to be provided of sufficient capacity to supply the fresh water distribution system with any one pump out of action.

3.4.2 The fresh water distribution system is to be capable of providing a steady flow of water at any point in the system in accordance with the *Fresh Water System Design Description*. Where a pneumatically pressurised tank arrangement is used, the tank is to be provided with water level indication and a means of indicating the pressure. The compressed air connection to the pressurised tank is to incorporate a non-return valve arrangement at the tank to prevent the possibility of water entering the compressed air system and it is recommended that the connection be made via a portable hose connection.

3.4.3 Each user or group of users of fresh water are to be provided with means of isolation such that the distribution system can continue to function when a user or group of users has been isolated.

3.4.4 Air vent and drain points are to be provided throughout the system at all high and low points.

3.4.5 Provision is to be made to connect an alternative source of fresh water supply in emergency conditions. Where the fresh water main is unavailable, stand-by arrangements are to be provided for fresh water supplies, which meet the required water quality, to medical spaces and galleys. The supply arrangements in emergency conditions are to be included in the *Fresh Water System Design Description* and agreed by the Owner.

3.4.6 There are to be no permanent connections between fresh water and sea water systems. Where emergency connections have been designed for the supply of fresh water to fresh and sea water cooled equipment, the fresh water is to be supplied by means of a portable hose with screw down non-return valve isolation arrangements at the connection to the equipment.

3.4.7 Calorifiers are to be provided with drainage arrangements and adequate access to enable cleaning.

3.4.8 Provision is to be made to sterilise all water supplies (including fresh water taken from shore, water barge or supply ship) for potable water by chlorination or by an equivalent sterilisation method. The residual quantities of chlorine and chlorodioxide are to be in accordance with ISO 15748-1.

3.4.9 The water supply arrangements for potable water are to be independent of other services wherever possible. Where there are no alternative supply arrangements to other services requiring fresh water (e.g. machinery cooling water, purifiers or a fresh water WC flushing system), a clear air break is to be provided in the fresh water supply pipe to such a system or tank. If it is impracticable to provide a clear air break, the supply pipe to each system is to be provided with an efficient non-return valve and a vacuum breaker or back-flow preventer.

3.4.10 Physical measures are to be in place to prevent incorrect connection between parts of the system which use different chemicals during all normal and reasonably foreseeable abnormal conditions.

3.5 Gas detection

3.5.1 Gas detection for hazardous gases resulting from water purification processes (e.g. chlorine, sulphur dioxide, ammonia, ozone and chlorine dioxide) is to comply with *Pt 7, Ch 2, 17 Gas detection* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice No. 1,2,3,4& 5*.

■ *Section 4*
Control, monitoring and electrical power arrangements

4.1 General

4.1.1 The control engineering arrangements are to comply with *Pt 6, Ch 1 General requirements*, as applicable.

4.1.2 Equipment used in fresh water systems is to be provided with local control and monitoring arrangements.

4.1.3 Where isolation of equipment or systems can be carried out, manual or automatic means of indicating the status of isolation is to be provided at all positions where the equipment and system can be operated and monitored.

4.1.4 Instrumentation to indicate the operational status of running equipment and of any standby equipment is to be provided locally and at each control station.

4.1.5 All pumps are to be provided with an indication of discharge pressure and a low discharge pressure alarm at each control station from which the pumps can be operated.

4.1.6 Sea water desalination plant instrumentation is to include, as a minimum, salinity indication and a high salinity alarm of the

desalinated water at the plant and at each control station.

4.1.7 Arrangements are to be made to automatically divert any water that is above the specified salinity limit from distribution into the on-specification fresh water storage system.

4.1.8 Sea water desalination plants using reverse osmosis are to be provided with automatic means of sterilising the desalinated water downstream of the plant.

4.1.9 Calorifiers are to be provided with a means of indicating and controlling the outlet temperature of fresh water to distribution systems. Low and high temperature alarms are to be provided in the hot water distribution system at each control station.

4.1.10 The electrical engineering arrangements are to comply with *Pt 6, Ch 2 Electrical Engineering.*

■ *Section 5*
Testing and trials

5.1 Testing

5.1.1 The requirements of the Rules relating to testing of pressure vessels, piping and related fittings including hydraulic testing are applicable, *see Pt 5, Ch 11, 10 Hydraulic tests* and *Pt 5, Ch 12, 8 Hydraulic tests on pipes and fittings* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5*.

5.1.2 On completion, tanks and reservoirs for service and storage of system fluids are to be tested by a head of water equal to the maximum to which the tanks may be subjected, but not less than 2,5 m above the crown of the tank.

5.1.3 After installation on board, piping systems that are under internal pressure, are to be subjected to a running test at the intended maximum working pressure.

5.1.4 Testing is to cover the following items:
(a) Verification of control, alarm, safety systems.
(b) Tests simulating failure of fresh water production equipment and pumps to verify correct functioning of alarms and systems in service.
(c) Verification of accuracy, calibration and functioning of temperature control for hot water heating, monitoring and recording instrumentation for sea water desalination plants where fitted.

5.1.5 Fresh water systems for potable water are to be cleaned and sterilised after testing in accordance with equipment manufacturer's installation instructions and a recognised National or International Standard e.g. BS 7593 *Code of practice for treatment of water in domestic hot water central heating systems*. The quality of potable water is subsequently to be tested by an accredited laboratory to confirm that the water quality meets that defined in the World Health Organisation's *Guidelines for Drinking Water Quality*. Separate water samples are to be taken from the outlet of the sea water desalination plant and at an outlet from the potable water storage tank using water which has been in the tank for not less than 24 hours.

5.2 Type testing

5.2.1 Evidence that the required performance of fresh water production and pumping equipment is capable of being maintained under ambient and inclination operating conditions defined in *Pt 5, Ch 1, 3.5 Ambient reference conditions* of the *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice No. 1,2,3,4& 5* and *Pt 5, Ch 1, 2 Operating conditions* is to be provided by the manufacturer.

5.3 Trials

5.3.1 Trials are to be carried out to demonstrate that the capability of the sea water desalination plant and fresh water system meet the system performance requirements.

■ *Section 6*
Survey

6.1 General

6.1.1 The requirements for survey are given in *Pt 1, Ch 3, 2.8 Sea water Desalination Plants and Fresh Water Systems*.

Part 6, Chapter 1
Control Engineering Systems

■ *Section 1*
General requirements

1.2 Documentation required for design review

(*Part only shown*)
1.2.3 Documentation for the control, alarm and safety systems of the following is to be submitted as applicable:
(e) **Pipe-laying systems**
~~(e)~~(f) **Riser systems.**

■ *Section 2*
Essential features for control, alarm and safety systems

2.2 Control stations for machinery and equipment

2.2.2 Means of communication are to be provided as applicable between the main control station, subsidiary stations, the workstation(s) for navigation and manoeuvring, the bridge area where applicable, the unit manager's office, the drill floor, the tool pusher's office, areas for pipe-laying operations (as defined in *Pt 3 Ch 17, 1.1 Application 1.1.1*) and the accommodation for operating personnel.

■ *Section 6*
Integrated computer control – ICC notation

6.1 General

6.1.1 Integrated Computer Control class notation ICC may be assigned where an integrated computer system in compliance *with Pt 6, Ch 1, 6 Integrated computer control - ICC notation* of the ~~Rules for Ships~~ *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5* provides fault tolerant control and monitoring functions for one or more of the following services:

- Propulsion and auxiliary machinery.
- Dynamic positioning systems.
- Positional mooring systems.
- Ballast systems.
- Process and utilities.
- Drilling equipment.
- Product storage and transfer systems.
- Pipe-laying systems.

Part 6, Chapter 2
Electrical Engineering

■ *Section 1*
General requirements

1.6 Definitions

1.6.4 Services such as the following, which are additional to those in *Pt 6, Ch 2, 1.6 Definitions 1.6.2* and *Pt 6, Ch 2, 1.6 Definitions 1.6.3*, are considered necessary to maintain the unit in a normal and sea-going operation and habitable condition:

- Drilling plant equipment;
- Processing and production equipment;
- Hotel services, other than those required for habitable conditions;
- Thrusters, other than those for essential services;
- Lifting appliances for the transfer of material, equipment or personnel; and
- Pipe-laying systems.

■ *Section 2*
Main source of electrical power

2.2 Number and rating of generators and converting equipment

2.2.1 The requirements for the number and rating of generators and converting equipment are given in *Pt 6, Ch 2, 2 Main source of electrical power* of the ~~Rules for Ships~~ *Rules and Regulations for the Classification of Ships, July 2016, incorporating Notice Nos 1,2,3,4&5*, which are to be complied with where applicable. Additions or amendments to these requirements are given in the following paragraph(s) of this sub-Section.

NOTE

The requirements are applicable when a unit is changing its location (self-propelled or towed) or stationary engaged in its primary function (e.g. drilling, pipe-laying, production or lifting, oil storage).

■ *Section 3*
Emergency source of electrical power

3.2 Emergency source of electrical power

(*Part only shown*)

3.2.4 The electrical power available is to be sufficient to supply all those services that are essential for safety in an emergency, due regard being paid to such services as may have to be operated simultaneously. The emergency source of electrical power is to be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the following services for the periods specified hereinafter, if they depend upon an electrical source for their operation:

(a) For a period of 18 hours, emergency lighting:

(xi) in all spaces from which control of the drilling process or pipe-laying operations (as defined in *Pt 3 Ch 17, 1.1 Application 1.1.1*) is performed and where controls of machinery essential for the performance of this process, or devices for emergency switching off of the power plant are located; and

■ ~~*Appendix A*~~
~~Codes, Standards and Equipment Categories~~

Has been deleted in its entirety, restructured with content amendment and relocated to the newly added Part 12, Chapter 1.

Part 7, Chapter 1
Safety and Communication Systems

■ *Section 1*
General requirements

1.1 General

1.1.1 This Chapter applies to all units defined in *Pt 1, Ch 2 Classification Regulations* on board which drilling, production and processing of hydrocarbons and/or storage of crude oil in bulk, or pipe-laying operations (as defined in *Pt 3 Ch 17, 1.1 Application 1.1.1*) is undertaken. It is also applicable to Accommodation Units and Support Units as detailed in *Pt 3, Ch 4 Accommodation and Support Units*. However, Accommodation Units and Support Units not engaged in activities with drilling, production and processing of hydrocarbons and/or storage of crude oil in bulk ~~units~~, or pipe-laying operations need not comply with all the requirements of *Pt 7, Ch 1, 2 Fire and gas alarm indication and control systems*, in relation to gas detection, or the requirements of *Pt 7, Ch 1, 5 Protection against gas ingress into safe areas*, Pt 7, Ch 1, 6 *Protection against gas escape in enclosed and semi-enclosed hazardous areas*, *Pt 7, Ch 1, 7 Emergency shutdown (ESD) systems* or *Pt 7, Ch 1, 8 Emergency release systems (ERS)* of this Chapter. This Chapter also states the fire detection requirements for units to be assigned the **UMS** and **CCS** notations, *see Pt 6, Ch 1, 4 Unattended machinery space(s) – UMS notation* and *Pt 6, Ch 1, 5 Machinery operated from a centralised control station – CCS notation*. Attention is to be given to the relevant Statutory Regulations of the National Administrations in the country of registration and area of operation, as applicable.

1.2 Documentation

(*Part only shown*)

1.2.1 The following documentation, as far as applicable to the unit, are to be submitted:

(c) For protection against gas and smoke in safe and hazardous areas:

- Layout drawing of drilling and/or process equipment or pipe-laying systems and gas detectors.
- Ventilation system flow diagrams and gas detectors.

■ *Section 3*
Systems for broadcasting safety information

3.3 General emergency alarm systems

3.3.2 A general alarm (GA) system is to be provided which is to be audible in all parts of the unit. Alarm signal devices are to produce a distinctive and strong note. The IMO Code on Alerts and Indications, 2009 should be referenced.

■ *Section 6*
Protection against gas escape in enclosed and semi-enclosed hazardous areas

6.1 General

6.1.2 Appropriate gas detectors are to be provided, to give warning of gas release in the following locations:

- Drill floor.
- Mudrooms.
- Shale shaker space.
- Wellhead and riser areas.
- Adjacent to process equipment.
- Machinery rooms with gas-fuelled equipment.
- Turret area.
- Areas for pipe-laying operations (as defined in *Pt 3 Ch 17, 1.1 Application 1.1.1*).
- Any other location where there is a significant risk of a leakage of gas or of liquid liable to release flammable vapour.

Part 7, Chapter 2
Hazardous Areas and Ventilation

■ *Section 1*
Hazardous areas – General

1.1 Application

1.1.1 Units for oil and gas exploitation, units with production and process plant, drilling plant, pipe-laying system and other units where explosive gas-air mixtures are likely to be present are to be classified into 'hazardous areas' and 'non-hazardous areas' in accordance with the requirements of this Chapter, or alternatively, with an acceptable Code or Standard giving equivalent safety.

■ *Section 6*
Ventilation

6.1 General requirements

6.1.5 Ventilation services to areas for pipe-laying operations (e.g. pipe welding and coating, as defined in *Pt 3 Ch 17, 1.1 Application 1.1.1*) or drilling utilities areas and to wellhead areas should, where practicable, be separate from services to other hazardous areas.

Part 7, Chapter 3
Fire Safety

■ *Section 3*
Additional requirements for units with drilling and/or production and process plant or pipe-laying system

3.4 Water deluge systems, water monitors and foam systems

3.4.1 The topside area of each installation or unit is to be provided with a water deluge system and/or water monitor system by means of which any part of the installation or unit containing equipment used for storing, conveying or processing hydrocarbon resources (other than fuels for use on the unit) can be protected in the event of fire. Areas containing equipment requiring water protection include the following:

- Any drilling facilities including the BOP.
- Areas containing equipment, (including piping) through which hydrocarbons will flow during well test operations.
- Crude oil and gas manifolds/piping (not fuel gas), including piping routed over bridges between platforms.
- Crude oil pumps.
- Crude oil storage vessels.
- De-aeration/filtration equipment (if using gas).
- Emergency shut-down valves.
- Flare knockout drums.
- Gas compressors.
- Gas liquids/condensate storage vessels.
- Glycol regeneration plant.
- Liquefaction plant.
- Pig launchers/receivers.
- Process pressure vessels.
- Process separation equipment.
- Riser connections.
- Swivel stack areas.
- Turret areas.
- Areas for pipe-laying operations (as defined in *Pt 3 Ch 17, 1.1 Application 1.1.1*).

3.4.9 With regard to the performance requirements for foam systems (concentration levels, discharge time, method of induction, etc.), particular attention is to be given to the design criteria outlined in NFPA 16 or Chapter 6 of the IMO FSS Code or in the case of Fixed Deck Foam Systems, Chapter 14 of the IMO FSS Code. Alternatively, ~~or~~ reference is to be made to an acceptable equivalent standard.

3.4.13 For the electrical safety of electrical and electronic equipment in areas protected by fixed water-based local application fire-fighting systems and adjacent areas exposed to direct spray, the exposed equipment are to have a degree of protection not less than IP44.

3.7 Other fixed fire-extinguishing systems

3.7.3 With regard to the performance requirements for fixed gaseous fire-extinguishing systems, particular attention should be given to the requirements of IMO FSS Code Chapter 5. Reference can also be made to an acceptable equivalent standard (such as NFPA 12 for Carbon Dioxide systems and NFPA 2001 for 'Clean Agent' fixed gaseous fire-extinguishing systems) for project-specific applications.

3.7.4 For the electrical safety of electrical and electronic equipment in areas protected by fixed water-based local application fire-fighting systems (i.e. a water mist system) and adjacent areas exposed to direct spray, the exposed equipment are to have a degree of protection not less than IP44. Alternatively other measures are to be considered (e.g. utilising only de-ionised water in the water mist system). Evidence is required to demonstrate the safe and effective operation of the overall arrangements in the event of system operation. This evidence is to demonstrate that exposure to system spray and/or water:

- cannot result in loss of availability of emergency services;
- will not affect the continued safe and effective operation of electrical and electronic equipment required to operate during the required period of system operation;
- does not present additional electrical or fire hazards; and
- would require only identified readily replaceable components to be repaired or replaced.

Part 8, Chapter 1
General Requirements for Corrosion Control

■ *Section 1*
Corrosion protection

1.1 Application

1.1.3 The basic Rule scantlings of the external submerged steel structure of units which are derived from *Pt 4 Steel Unit Structures* assume that a cathodic protection system will be effective and in use continually. ~~Unless agreed otherwise with LR no corrosion allowance will be included in the approved scantlings, *see Pt 3, Ch 1, 5 Corrosion control*.~~

Part 10, Chapter 3
Scantling Requirements

■ *Section 1*
Scantling requirements

1.4 Hull girder shear strength

1.4.1 **General.**

(a) The hull girder shear strength requirements apply along the full length of the hull girder, from AP to FP.

(b) The following requirements are applicable to units with standard structural arrangements as shown in ~~*Pt 10, Ch 3, 1.4 Hull girder shear strength 1.4.2*~~ *Table 3.1.2 Shear force distribution factors*. Alternative configurations will be specially considered.

(*Part only shown*)

1.4.2 **Assessment of hull girder shear strength.**

(a) The net hull girder shear strength capacity, $Q_{v-net50}$, is not to be less than the required vertical shear force, Q_{v-req}:

$Q_{v-req} = Q_{sw-perm} + Q_{wv}$ kN

where

$Q_{sw-perm}$ = permissible hull girder positive or negative still water shear force as given in ~~*Pt 10, Ch 3, 1.4 Hull girder shear strength 1.4.2*~~ *Table 3.1.3 Loads and corresponding acceptance criteria for hull girder shear assessment*, in kN

Q_{wv} = vertical wave positive or negative shear force as defined in ~~*Pt 10, Ch 3, 1.4 Hull girder shear strength 1.4.2*~~ *Table 3.1.3 Loads and corresponding acceptance criteria for hull girder shear assessment*, in kN.

(b) The permissible positive and negative still water shear forces $Q_{sw-perm}$, are to satisfy the following for each location

$\tau_{ij-perm}$ = permissible hull girder shear stress, τ_{perm}, as given in ~~*Pt 10, Ch 3, 1.4 Hull girder shear strength 1.4.2*~~ *Table 3.1.3 Loads and corresponding acceptance criteria for hull girder shear assessment*, in N/mm^2, for plate ij

Q_{wv-pos} = positive vertical wave shear force, in kN, as defined in ~~*Pt 10, Ch 3, 1.4 Hull girder shear strength 1.4.2*~~ *Table 3.1.3 Loads and corresponding acceptance criteria for hull girder shear assessment*

Q_{wv-neg} = negative vertical wave shear force, in kN, as defined in *Pt 10, Ch 3, 1.4 Hull girder shear strength 1.4.2 Table 3.1.3 Loads and corresponding acceptance criteria for hull girder shear assessment*

f_i = shear force distribution factor for the main longitudinal hull girder shear carrying members being considered. For standard structural configurations f_i is as defined in ~~*Pt 10, Ch 3, 1.4 Hull girder shear strength 1.4.2*~~ *Table 3.1.2 Shear force distribution factors*.

$I_{v-net50}$ = net vertical hull girder section moment of inertia, in m^4 to be calculated in accordance with ~~Pt 10, Ch 3, 1.3 Hull girder bending strength 1.3.2 *(b)*~~ *Pt 10, Ch 3, 1.3 Hull girder bending strength 1.3.4(b)*.

(*Part only shown*)

Table 3.1.3 Loads and corresponding acceptance criteria for hull girder shear assessment

Design load combination	Still water shear force $Q_{sw-perm}$	Vertical wave shear force Q_{wv}	Permissible shear stress, τ_{perm}, *see* Note
Symbols			
$Q_{sw-perm}$ =	permissible positive or negative hull girder still water shear force for Static (S) or Static + Dynamic (S + D) design load combination, as applicable from ~~*Pt 10, Ch 2, 6.1 Symbols 6.1.1* in *Pt 10, Ch 2 Loads and Load Combinations*~~ *Pt 10, Ch 2, Table 2.6.1 Design load combinations* for the load case under consideration, in kN		

(*Part only shown*)

1.4.3 **Shear force correction for longitudinal bulkheads between cargo tanks.**

(b) The vertical distribution of thickness reduction for shear force connection is assumed to be triangular, as indicated in *Pt 10, Ch 3, ~~1.4 Hull girder shear strength 1.4.3~~ Figure 3.1.1 Shear force correction for longitudinal bulkheads*. The thickness deduction, t_Δ, to account for shear force correction is to be taken as:

$$t_\Delta = \frac{\delta_{Q3}}{h_{blk}\,\tau_{ij-perm}}\left(1-\frac{x_{blk}}{0{,}5 l_{tk}}\right)\left(2-\frac{2(z_p - h_{db})}{h_{blk}}\right)$$

where

h_{blk} = height of longitudinal bulkhead, in metres, defined as the distance from inner bottom to the deck at the top of the bulkhead, as shown in ~~*Pt 10, Ch 3, 1.4 Hull girder shear strength 1.4.3*~~ *Figure 3.1.1 Shear force correction for longitudinal bulkheads*

h_{db} = height of double bottom, in metres, as shown in ~~*Pt 10, Ch 3, 1.4 Hull girder shear strength 1.4.3*~~ *Figure 3.1.1 Shear force correction for longitudinal bulkheads*

(c) For ship units with ~~a~~ one or two centreline longitudinal bulkheads between the cargo tanks, the shear force correction in way of transverse bulkhead, δ_{Q3}, is to be taken as:

$\delta_{Q3} = 0{,}5K_3 F_{db}$ kN

where

F_{db} = maximum resulting force on the double bottom in a tank, in kN, as defined in ~~*Pt 10, Ch 3, 1.4 Hull girder shear strength 1.4.3(g)*~~ *Pt 10, Ch 3, 1.4 Hull girder shear strength 1.4.3 (h)*.

(d) For ship units with ~~a~~ one or two centreline longitudinal bulkheads between the cargo tanks, the correction factor, K_3, in way of transverse bulkheads is to be taken as:

$$K_3 = \left[0{,}4\left(1 - \frac{1}{1+n}\right) - f_3 \right]$$

where

n = number of floors between transverse bulkheads

f_3 = shear force distribution factor, *see Pt 10, Ch 3, ~~1.4 Hull girder shear strength 1.4.2~~ Table 3.1.2 Shear force distribution factors*.

(i) The effective net plating thickness of the plating, $t_{sfc\text{-}net50}$, used for calculation of hull girder shear strength, $Q_{v\text{-}net50}$, is to comply with the minimum thickness requirements for the cargo region given in *Pt 10, Ch 3, 2.2 General 2.2.4* and *Pt 10, Ch 3, 2.2 General 2.2.5*.

(j) The structure is to be subsequently confirmed as compliant using direct calculations in terms of both stress and buckling.

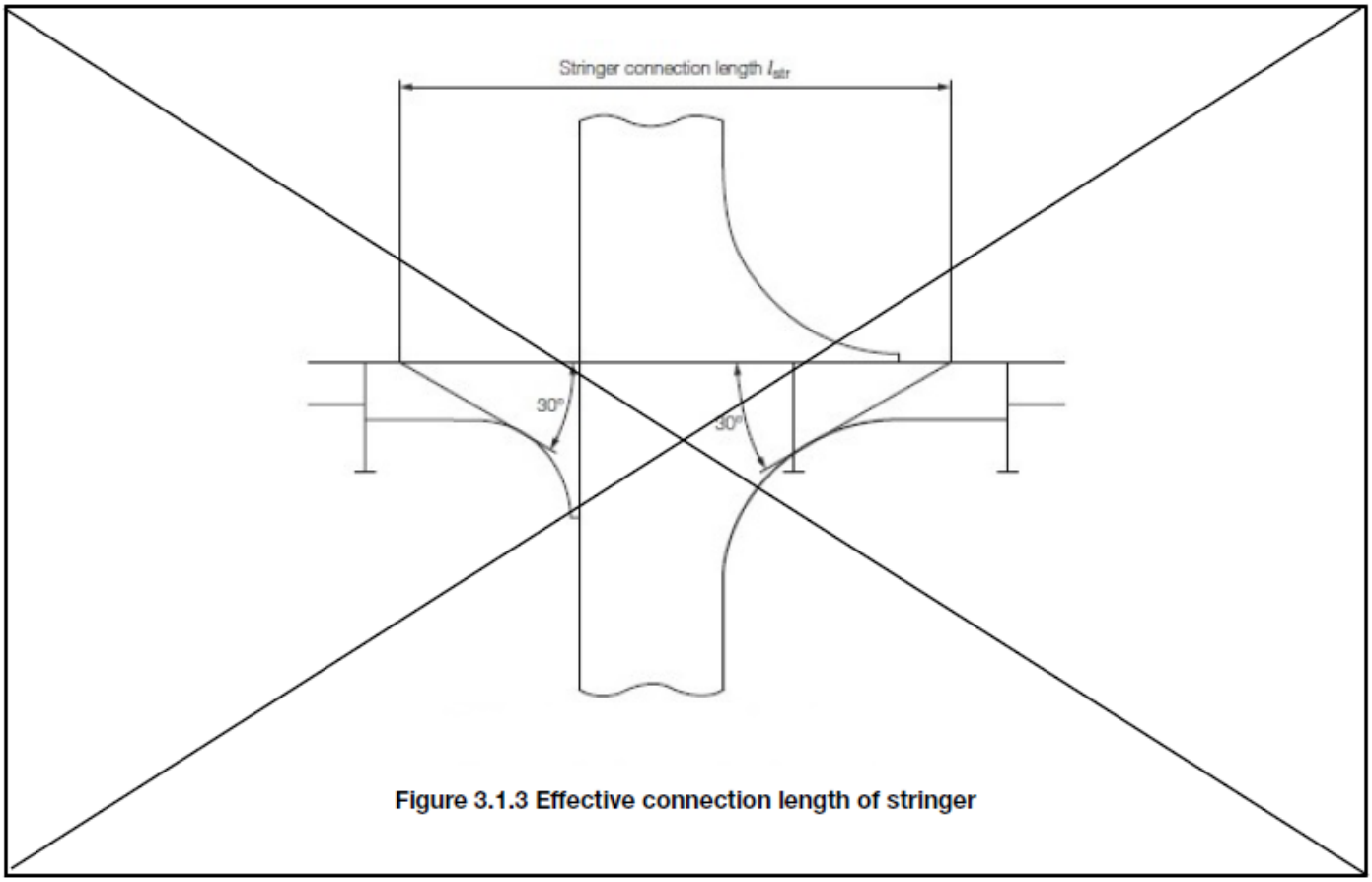

Figure 3.1.3 Effective connection length of stringer

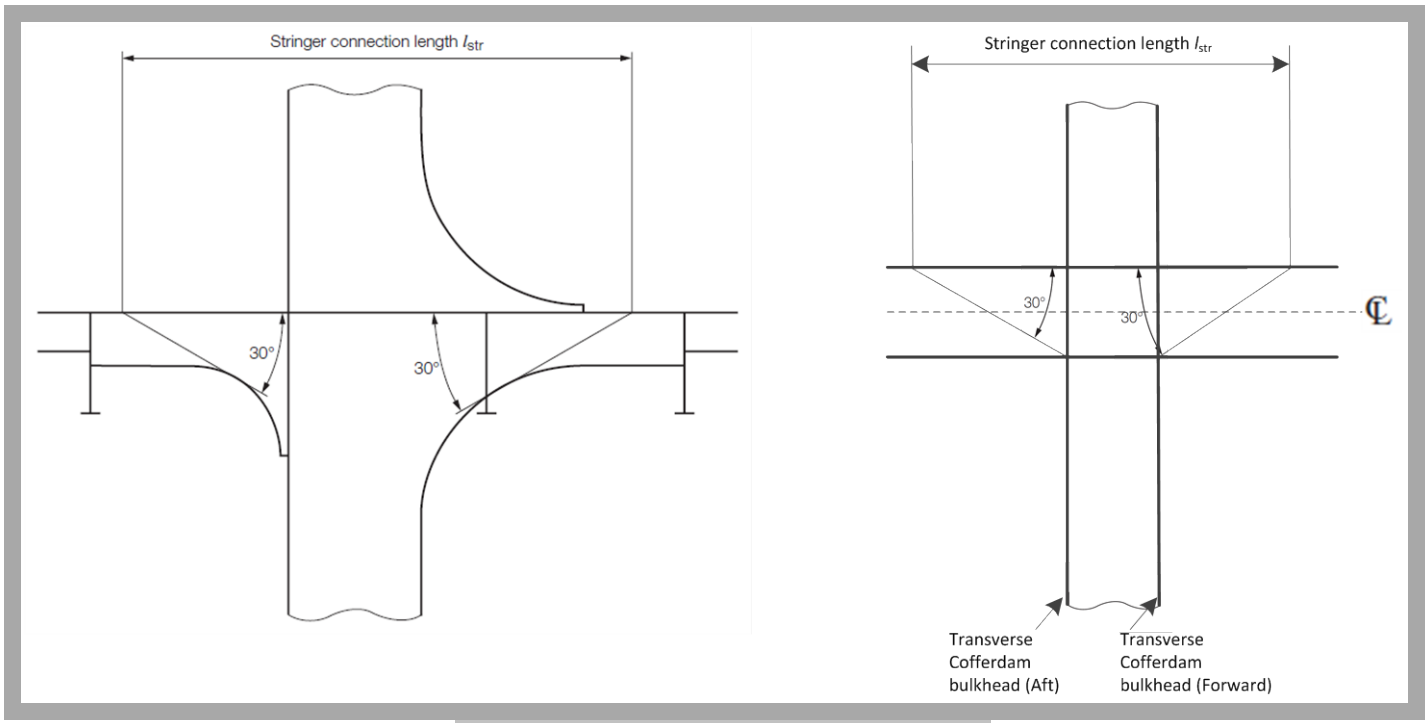

Figure 3.1.3 Effective connection length of stringer

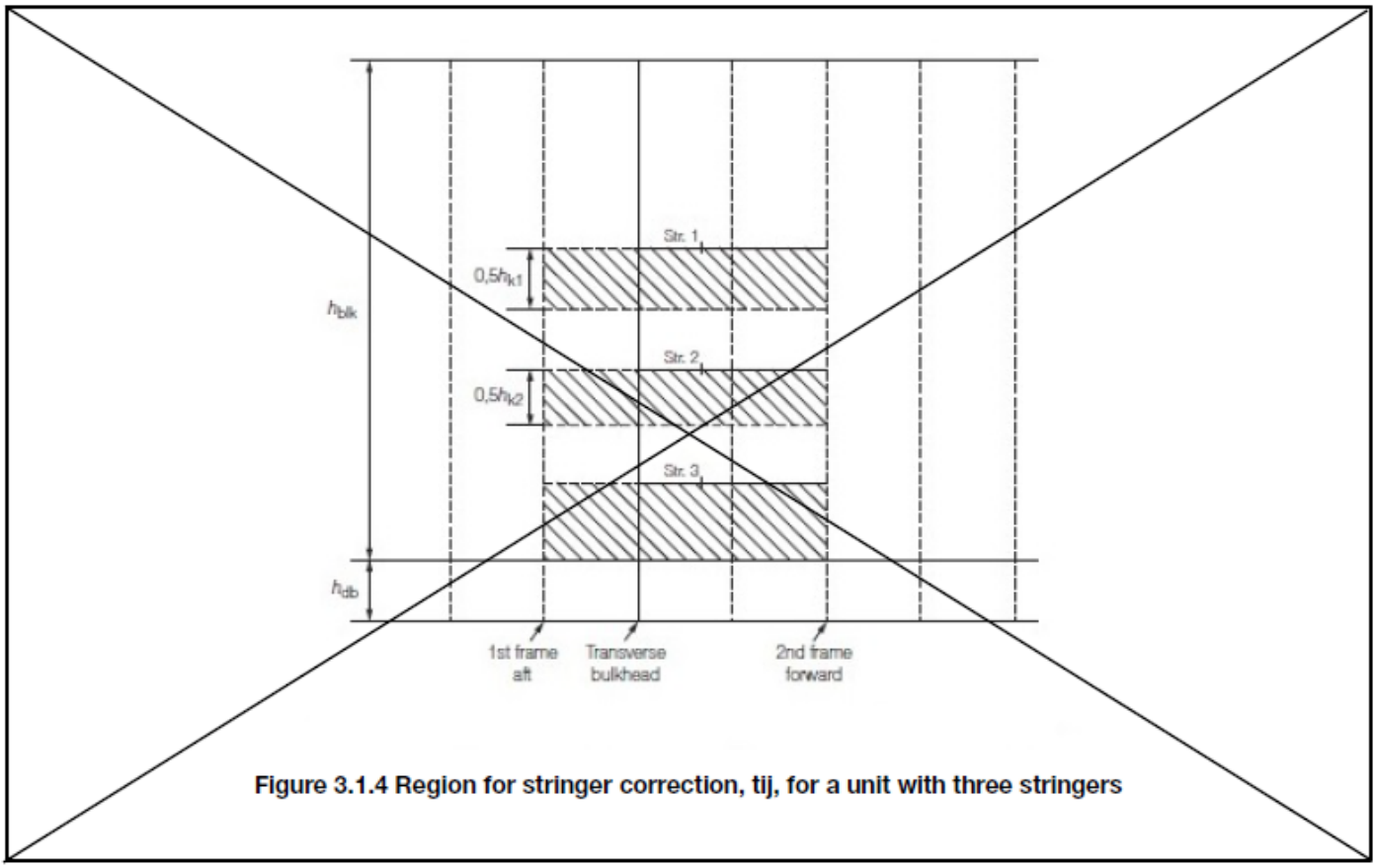

Figure 3.1.4 Region for stringer correction, tij, for a unit with three stringers

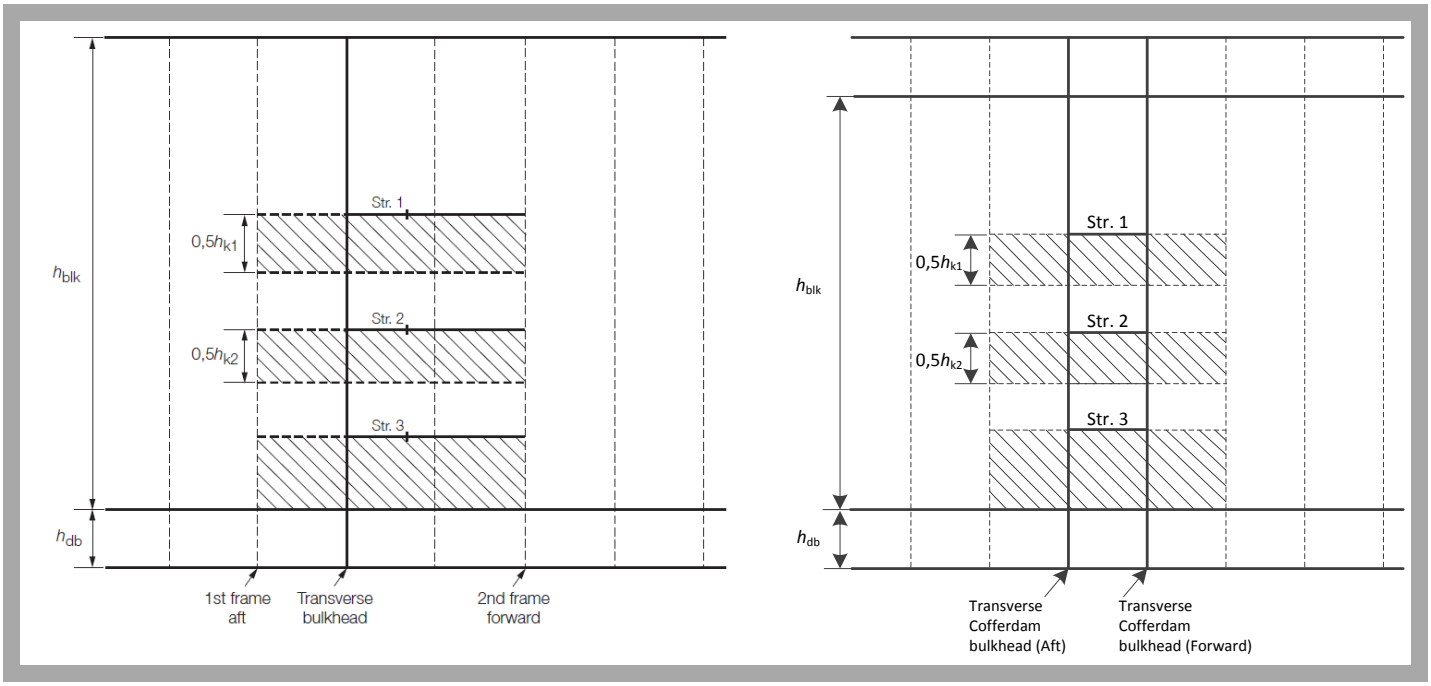

Figure 3.1.4 Region for stringer correction, tij, for a unit with three stringers

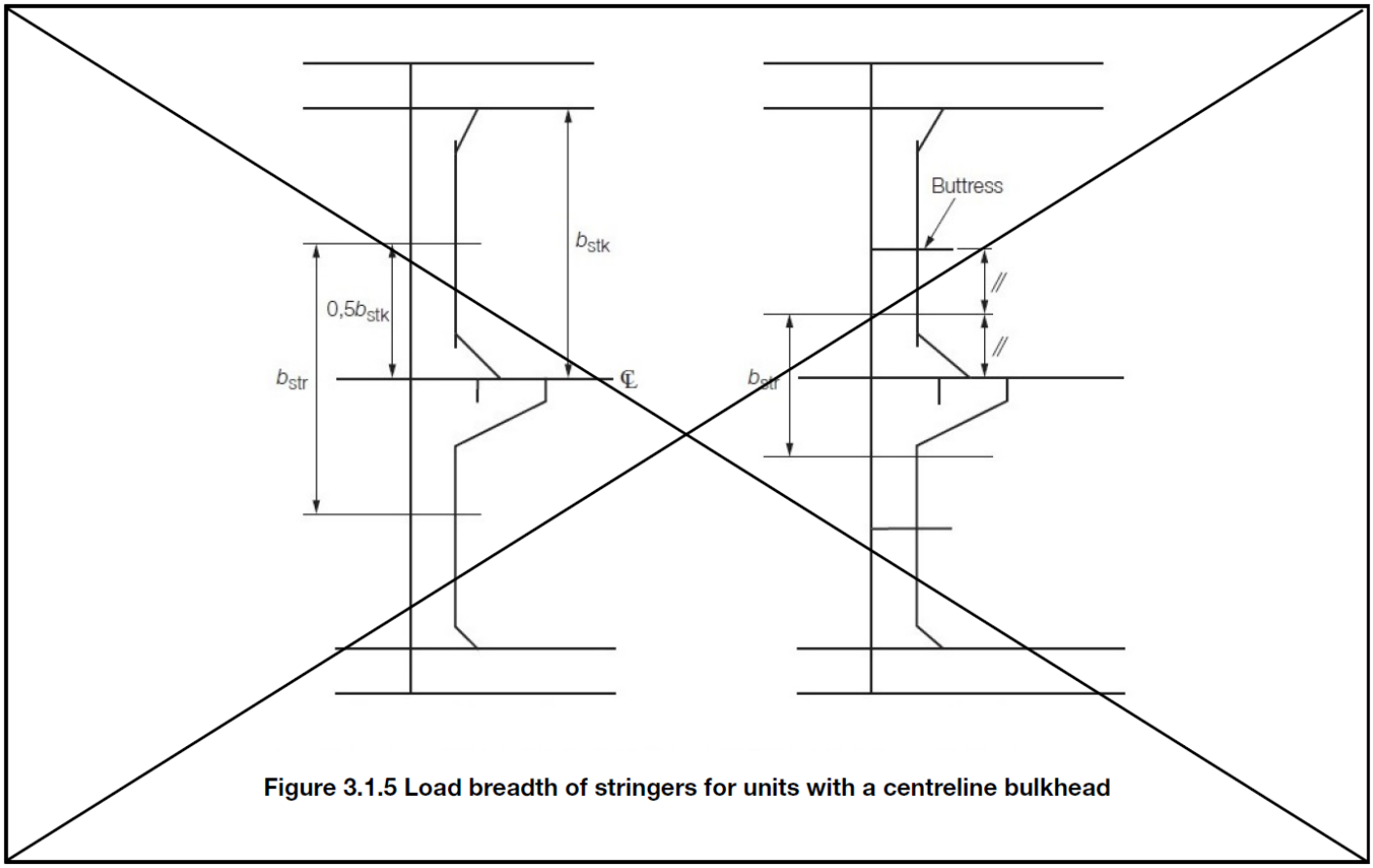

Figure 3.1.5 Load breadth of stringers for units with a centreline bulkhead

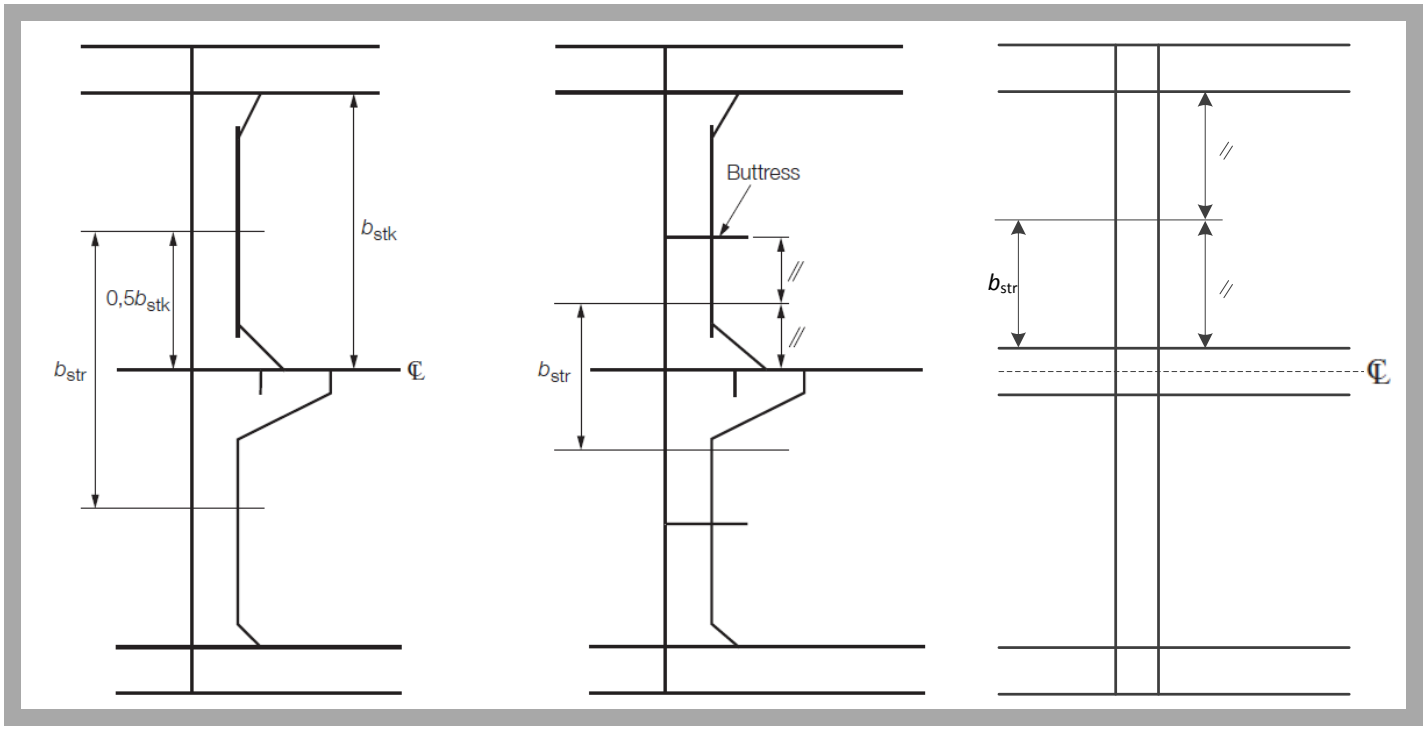

Figure 3.1.5 Load breadth of stringers for units with ~~a~~ one or two centreline longitudinal bulkheads

(*Part only shown*)

1.4.4 **Shear force correction due to loads from transverse bulkhead stringers.**

(a) In way of transverse bulkhead stringer connections, within areas as specified in *Pt 10, Ch 3, ~~1.4 Hull girder shear strength 1.4.4~~ Figure 3.1.4 Region for stringer correction, t_{ij}, for a unit with three stringers*, the equivalent net thickness of plate used for calculation of the hull girder shear strength, t_{str-k} , where the index k refers to the identification number of the stringer, is not to be taken greater than:

$$t_{str-k} = t_{sfc-net50}\left(1-\frac{\tau_{str}}{\tau_{ij-perm}}\right) \text{ mm}$$

τ_{str} is not to be taken greater than $\tau_{ij-perm}$

where

l_{str} = connection length of stringer, in metres, *see Pt 10, Ch 3, ~~1.4 Hull girder shear strength 1.4.4~~ Figure 3.1.3 Effective connection length of stringer*

h_{db} = the double bottom height, in metres, as shown in *Pt 10, Ch 3, ~~1.4 Hull girder shear strength 1.4.4~~ Fig 3.1.4 Effective connection length of stringer*

h_{blk} = height of bulkhead, in metres, defined as the distance from inner bottom to the deck at the top of the bulkhead, as shown in *Pt 10, Ch 3, ~~1.4 Hull girder shear strength 1.4.4~~ Fig 3.1.4 Effective connection length of stringer*

(b) The total stringer supporting force, F_{str-k}, in way of a longitudinal bulkhead is to be taken as:

$$F_{str-k} = \frac{P_{str} b_{str} \left(h_k + h_{k-1}\right)}{2}$$

where

P_{str} = pressure on stringer, in kN/m^2, to be taken as $\rho g h_{tt}$ ~~$10 h_{tt}$~~

b_{str} = load breadth acting on the stringer, in metres, ~~see~~ *see ~~Pt 10, Ch 3, 1.4 Hull girder shear strength 1.4.4~~* and *~~Pt 10, Ch 3, 1.5 Hull girder buckling strength 1.5.2~~ Figure 3.1.5* Load breadth of stringers for units with ~~a~~ one or two centreline longitudinal bulkheads *and Figure 3.1.Load breadth of stringers for units with two inner longitundinal bulkheads*.

ρ = density, tonnes/m^3, as defined in *Pt 10, Ch 2, 1.2 Definitions 1.2.3*

g = acceleration due to gravity, 9,81 m/s^2

(d) The equivalent net thickness of plate used for calculation of the hull girder shear strength, t_{str-k}, is to comply with the minimum thickness requirements for the cargo region given in *Pt 10, Ch 3, 2.2 General 2.2.4* and *Pt 10, Ch 3, 2.2 General 2.2.5*.

(e) The structure is to be subsequently confirmed as compliant using direct calculations in terms of both stress and buckling.

Part 11 Chapter 5
Process Pressure Vessels and Liquids, Vapour and Pressure Piping Systems and Offshore Arrangements

■ *Section 4*
Pipework

4.2 Welding, post-weld heat treatment and non-destructive testing

4.2.3 **Non-destructive testing**

In addition to normal controls before and during the welding, and to the visual inspection of the finished welds, as necessary for proving that the welding has been carried out correctly and according to the requirements of this paragraph, the following tests shall be required:

(a) 100 per cent radiographic or ultrasonic inspection of butt-welded joints for piping systems with design temperatures colder than –10°C, ~~or~~ and with inside diameters of more than 75 mm, or wall thicknesses greater than 10 mm;

■ *Section 5*
Components

5.1 Piping system requirements

5.1.4 **Flanges, valves and fittings**

(c) All emergency shutdown valves shall be of the '~~fire~~ fail-closed' type. (*See Pt 11, Ch 5, 6.2 Testing requirements 6.2.1* and *Pt 11, Ch 18, 4.2 ESD valve requirements*).

Part 11, Chapter 13
Instrumentation and Automation Systems

■ *Section 1*
Instrumentation and Automation Systems

1.6 Gas detection

1.6.4 For ship units permitted to store non-flammable products, oxygen deficiency monitoring shall be fitted in cargo machinery spaces and ~~cargo tank~~ hold spaces for independent tanks other than type C tanks. Furthermore, oxygen deficiency monitoring equipment shall be installed in enclosed or semi-enclosed spaces containing equipment that may cause an oxygen-deficient environment such as nitrogen generators, inert gas generators or nitrogen cycle refrigerant systems.

Part 12, Recognised Codes and Standards for the Classification of Offshore Units
Chapter 1 – Recognised Codes and Standards

■ *Section 1*
Abbreviations for recognised codes and standards

1.1 Abbreviations

1.1.1 The following abbreviations are used in this Appendix:
AISC American Institute of Steel Construction.
ANSI American National Standards Institute.
API American Petroleum Institute.
ASME American Society of Mechanical Engineers.
BCGA British Compressed Gas Association.
BS British Standard.
CAA. United Kingdom Civil Aviation Authority.
CAP. Civil Aviation Publication.
CSA Canadian Standards Association.
DIN Deutsches Institut fur Normung.
EEMUA Engineering Equipment & Materials Users Association.
EN. European Standard.
FEM Federation Europeenne de la Manutention.
IACS International Association of Classification Societies.
IEC. International Electrotechnical Commission.
IEEE. Institute of Electrical and Electronics Engineers.
IMCA. International Marine Contractors Association.
IP International Petroleum.
ISO International Standards Organisation.
NACE National Association of Corrosion Engineers.
NFPA National Fire Protection Association.
NIPH Norwegian Institute of Public Health.
NS Norwegian Standard.
OGP International Association of Oil and Gas Producers.
SGMF The Society for Gas as a Marine Fuel.
TBK Norwegian Pressure Vessel Committee.
UKOOA United Kingdom Offshore Operators Association.

■ *Section 2*
The use of recognised codes and standards for offshore units

2.1 General Information

2.1.1 The Codes and Standards detailed in this chapter are recognised by LR in connection with the design, construction and installation of equipment which form part of the offshore unit as appropriate.

2.1.2 These Codes and Standards are subject to change/deletion without notice. The latest edition of a Code or Standard, with all applicable addenda, current at the date of contract award should be used.

2.1.3 When requested, other National and International Codes and Standards may be used after special consideration and agreement by LR.

■ *Section 3*
Bearings

3.1 Recognised codes and standards for bearings

3.1.1 The following Codes and Standards are recognised by LR:
ANSI/AFBMA Std 11 Load Ratings and Fatigue Life for Roller Bearings.
ASME 77-DE-39 Design Criteria to Prevent Core Crushing Failure in Large Diameter Case Hardened Ball and Roller Bearings.
BS 5512:1/ISO 281Dynamic Load Ratings and Rating Life of Rolling Bearings.
BS 5645:/ISO 76Static Load Ratings for Rolling Bearings.

ISO 281 Roller Bearing-Dynamic Load Ratings and Rating Life.
ISO 10438 (all parts) Petroleum and natural gas industries – Lubrication, shaft-sealing and control-oil systems and auxiliaries.

■ *Section 4*
Blow out prevention

4.1 Recognised codes and standards for blow out prevention

4.1.1 The following Codes and Standards are recognised by LR:
API Spec. 16A Specification for Drill through Equipment.
API Spec. 16D Specification for Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment.
API Spec.16F Specification for Marine Drilling Riser Equipment.
API Std 53 Blowout Prevention Equipment Systems for Drilling Operations.
API RP 16E Design of Control Systems for Drilling Well Control Equipment.

■ *Section 5*
Coating application

5.1 Recognised codes and standards for coating application

5.1.1 The following Codes and Standards are recognised by LR:
ISO 1461 Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods.
ISO 8501-1 Preparation of steel substrate before application of paints and related products – Visual assessment of surface. cleanliness – Part1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings.
ISO 12944 series Paints and varnishes – Corrosion protection of steel structures by protective paint systems.
ISO 20340 Paints and varnishes – Performance requirements for protective paint systems for offshore and related structures.

■ *Section 6*
Combustion engines and fuels

6.1 Recognised codes and standards for combustion engines and fuels

6.1.1 The following Codes and Standards are recognised by LR:
ISO 8217 Petroleum products - Fuels (class F) - Specifications of marine fuels.
ISO 22241 series - Diesel engines - NOx reduction agent AUS 32.

■ *Section 7*
Compressed air systems

7.1 Recognised codes and standards for compressed air systems

7.1.1 The following Codes and Standards are recognised by LR:
ISO 1217 Displacement compressors - Acceptance Tests.
ISO 8573 -1 Compressed Air - Part 1: Contaminants and purity classes.

■ *Section 8*
Compressed gas utility systems

8.1 Recognised codes and standards for compressed gas utility systems

8.1.1 The following Codes and Standards are recognised by LR:
BCGA Guidance Note 2 Guidance for the storage of gas cylinders in the workplace.
BCGA Code of practice CP7 The safe use of oxy-fuel gas equipment (individual portable or mobile cylinder supply).
BCGA Guidance Note GN11 Reduced oxygen atmospheres.
BS EN 1089-3 Transportable gas cylinders. Gas cylinder identification (excluding LPG). Colour coding.
BS EN ISO 7225 Gas cylinders. Precautionary labels.
BS 1710 Specification for identification of pipelines and services.
NFPA 51 Standard for the Design and Installation of Oxygen - Fuel Gas Systems for Welding, Cutting, and Allied Processes.
NFPA 55 Compressed Gases and Cryogenic Fluids Code.

IMO MODU Code 2009.

■ *Section 9*
Concrete structures

9.1 Recognised codes and standards for concrete structures

9.1.1 The following Codes and Standards are recognised by LR:
BS 8110 Structural Use of Concrete, Parts 1, 2 and 3.
CSA S471 General Requirements, Design Criteria, the Environment and Loads.
CSA S474 Concrete Structures, Offshore Structures.
ISO 19903 Fixed Concrete Structures.
NS 3473 Concrete Structures – Design Rules.
Other publications:

- Norwegian Petroleum Directorate, Guidelines relating to concrete structures to regulations relating to load bearing structures in the petroleum activities.

■ *Section 10*
Condition monitoring

10.1 Recognised codes and standards for condition monitoring

10.1.1 The following Codes and Standards are recognised by LR:
ISO 10816-1 series Mechanical vibration – Evaluation of machine vibration by measurements on non-rotating parts.
ISO 13373-1 and -2 Conditioning monitoring and diagnostics of machines - Vibration Conditioning Monitoring.
ISO 17359 Condition monitoring and diagnostics of machines – General guidelines.

■ *Section 11*
Control and electrical systems

11.1 Recognised codes and standards for control and electrical systems

11.1.1 The following Codes and Standards are recognised by LR:
CAP 437. Standards for Offshore Helicopter Landing Areas.
IEC 60034 series, Rotating electrical machines.
IEC 60038 IEC standard voltages.
IEC 60076. Power transformers.
IEC 60079. Explosive atmospheres.
IEC 60092-302. Electrical installations in ships — Part 302: Low-voltage switchgear and controlgear assemblies.
IEC 60092-502. Electrical installations in ships — Part 502: Tankers — Special features.
IEC 60092-503. Electrical installations in ships — Part 503: Special features — AC supply systems with voltages in the range of above 1 kV up to and including 15 kV.
IEC 60092-504. Electrical installations in ships — Part 504: Special features — Control and instrumentation.
IEC 60137. Insulated bushings for alternating voltages above 1 000 V.
IEC 60146. Semiconductor converters — General requirements and line commutated converters.
IEC 60204-32 Safety of Machinery – Electrical equipment of machines: part 32: requirements for hoisting machines.
IEC 60228 Nominal cross-sectional areas.
IEC 60255. Electrical Relays.
IEC 60269. Low-voltage fuses.
IEC 60282. High-voltage fuses.
IEC 60300-3-11 Dependability management - Part 3-11: Application guide - Reliability centered maintenance.
IEC 60331 series, Tests for electric cables under fire conditions, fire resistant cables.
IEC 60332 series, Tests on electric and fibre optic cables under fire conditions, flame retardant cables.
IEC 60445 Basic and safety principles for man-machine interface, marking and identification.
IEC 60502. Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV).
IEC 60529 Degrees of Protection Provided by Enclosures (IP Code).
IEC 60533 Electrical and electronic installations in vessel – Electromagnetic Compatibility (EMC).
IEC 60724. Short-circuit temperature limits of electric cables with rated voltages of 1 kV (Um = 1,2 kV) and 3 kV (Um = 3,6 kV).
IEC 60754 series, Tests on gases evolved during combustion of materials from cables.
IEC 60757 Code for designation of colours.
IEC 60812 Analysis for System Reliability – Procedure for Failure Mode and Effects Analysis (FMEA).
IEC 60839 Alarm and Electronic Security Systems.
IEC 60840. Power cables with extruded insulation and their accessories for rated voltages above 30 kV (Um = 36 kV) up to 150 kV (Um

= 170 kV) — Test methods and requirements.
IEC 60909 series, Short-circuit currents in three-phase a.c. systems.
IEC 60947. Low-voltage switchgear and controlgear.
IEC 60986. Short-circuit temperature limits of electric cables with rated voltages from 6 kV (Um = 7,2 kV) up to 30 kV (Um = 36 kV).
IEC 61000 Electro-Magnetic Compatibility (EMC).
IEC 61078 Analysis techniques for dependability – Reliability block diagram and Boolean methods.
IEC 61097 series, Global maritime distress and safety system (GMDSS).
IEC 61162 series, Maritime navigation and radio communication equipment and systems.
IEC 61363 Electrical installations of ships and mobile and fixed offshore units, calculating short-circuit currents.
IEC 61439. Low-voltage switchgear and controlgear assemblies.
IEC 61443. Short-circuit temperature limits of electric cables with rated voltages above 30 kV (Um = 36 kV).
IEC 61508 Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems (E/E/PE, or E/E/PES).
IEC 61508. Functional safety of electrical/electronic/programmable electronic safety-related systems.
IEC 61511 Functional Safety - Safety instrumented systems for the process industry sector.
IEC 61557 series, Electrical safety in low voltage distribution systems up to 1000 Vac, Insulation monitoring devices.
IEC 61892. Mobile and fixed offshore units — Electrical installations.
IEC 62040. Uninterruptible power systems (UPS).
IEC 62271-100. High-voltage switchgear and controlgear —Part 100: Alternating current circuit-breakers.
IEC 62271-102. High-voltage switchgear and controlgear —Part 102: Alternating current disconnectors and earthing switches.
IEC 62271-104. High-voltage switchgear and controlgear —Part 104: Alternating current switches for rated voltages of 52 kV and above.
IEC 62271-108. High-voltage switchgear and controlgear — Part 108: High-voltage alternating current disconnecting circuitbreakers for rated voltages of 72,5 kV and above.
IEC 62271-200. High-voltage switchgear and controlgear — Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV.
IEC 62271-201. High-voltage switchgear and controlgear —Part 201: AC insulation-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV.
IEC 62271-203. High-voltage switchgear and controlgear —Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV.
IEC 62271-205. High-voltage switchgear and controlgear — Part 205: Compact switchgear assemblies for rated voltages above 52 kV
IEC 62305 series, Protection against lightning.
IEC 62682 Management of Alarm Systems for the Process Industries.
IEEE 1584, IEEE Guide for Performing Arc Flash Hazard Calculations.
IEEE Std. 400.2. IEEE Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF) (less than 1 Hz).

■ *Section 12*
Corrosion protection

12.1 Recognised codes and standards for corrosion protection

12.1.1 The following Codes and Standards are recognised by LR:
BS EN 13173 Cathodic protection for steel offshore floating structures.

■ *Section 13*
Cryogenic process equipment

13.1 Recognised codes and standards for cryogenic process equipment

13.1.1 The following Codes and Standards are recognised by LR:
BS 6364 Specification for valves for cryogenic service - Appendix A applicable.
EEMUA 147 Recommendations for Liquefied Gas Storage Tanks.
EN 1160 Installations and equipment for liquefied natural gas. General characteristics of liquefied natural gas.
EN 12434 Cryogenic vessels – Cryogenic flexible hoses.
EN 1252-1 Cryogenic vessels – Materials – Part 1: Toughness requirements for temperatures below -80°C.
EN 1252-2 Cryogenic vessels – Materials – Part 2: Toughness requirements for temperatures between -80°C and -20°C.
EN 13371 Cryogenic vessels – Couplings for cryogenic service.
EN 14197-1 Cryogenic vessels – Static non-vacuum insulated vessels – Part 1: Fundamental requirements.
EN 14197-2 Cryogenic vessels – Static non-vacuum insulated vessels – Part 2: Design, fabrication, inspection and testing.
EN 14197-3 Cryogenic vessels – Static non-vacuum insulated vessels – Part 3: Operational Requirements.
EN 1473 Installation and equipment for liquefied natural gas. Design of onshore installations.
EN 1474-1 Installation and equipment for liquefied natural gas. Design and testing of marine transfer systems. Design and testing of transfer arms.
EN 1474-2 Installation and equipment for liquefied natural gas. Design and testing of marine transfer systems. Design and testing of transfer hoses.
EN 1474-3 Installation and equipment for liquefied natural gas. Design and testing of marine transfer systems. Offshore transfer

systems.
IACS Rec. No. 142 LNG Bunkering Guidelines.
IACS Rec. No. 146 Risk assessment as required by the IGF Code.
ISO 10497 Fire endurance testing for ESD valves.
ISO 10790 Guidance to the selection, installation and use of Coriolis flow meters.
ISO 10976 Measurement of cargoes on board LNG carriers.
ISO 18132-1 Tank gauges for LNG on board marine carriers and floating storage.
ISO 18132-2 General requirements for automatic level gauges – refrigerated.
ISO 20519 Ships and marine technology - Specification for bunkering of liquefied natural gas fuelled vessels.
ISO 21009-1 Static vacuum insulated vessels.
ISO 21010 Gas/materials compatibility for cryogenic vessels.
ISO 21011 Valves for cryogenic service.
ISO 21013-1 Pressure-relief accessories for cryogenic service – reclosable.
ISO 21013-2 Pressure-relief accessories for cryogenic service - non-reclosable.
ISO 21013-3 Pressure-relief accessories for cryogenic service – sizing.
ISO 21013-4 Pilot operated pressure relief devices.
ISO 21014 Cryogenic insulation performance.
ISO 24490 Pumps for cryogenic service.
ISO 28460 LNG Ship to shore interface.
ISO 28921-1 Isolating valves for low-temperature applications.
ISO 8143 Thermal insulation products for industrial installations.
ISO 8943 Sampling of liquefied natural gas -- Continuous and intermittent.
ISO/TS 17177 Guidelines for the marine interfaces of hybrid LNG terminals.
ISO/TS 18683 Guidelines for systems and installations for supply of LNG as fuel.
NFPA 59A Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)**.**
SGMF LNG Bunkering Safety Guidelines.

■ *Section 14*
Drilling equipment

14.1 Recognised codes and standards for drilling equipment

14.1.1 The following Codes and Standards are recognised by LR:
API 4E Drilling and Well Servicing Structures.
API RP 7G Drill Stem Design and Operating Limits.
API RP 8B Hoisting Tool Inspection and Maintenance Procedures.
API Spec. 7 Specification for Rotary Drilling Equipment.
API Spec. 8C Drilling and Production Hoisting Equipment (PSL 1 and PSL 2).
API Spec. 9A Wire Rope.
API RP 9B Application, Care and Use of Wire Rope for Oil Field Service.
ISO 10405 Petroleum and natural gas industries – Care and use of casing and tubing.
ISO 10407 Petroleum and natural gas industries – Drilling and production equipment – Drill stem design and operating limits.
ISO 10426 Petroleum and natural gas industries – Cements and materials for well cementing.
ISO 11960 Petroleum and natural gas industries – Steel pipes for use as casing or tubing for wells.
ISO 11961 Petroleum and natural gas industries – Steel pipes for use as drill pipe – Specification.
ISO 13500 Hydraulic fluid power – Determination of particulate contamination by automatic counting using the light extinction principle.
ISO 13533 Petroleum and natural gas industries – Drilling and production equipment – Drill-through equipment.
ISO 14693 Petroleum and natural gas industries – Drilling and well-servicing equipment.
ISO 13678 Petroleum and natural gas industries – Evaluation and testing of thread compounds for use with casing, tubing and line pipe.
ISO 13680 Petroleum and natural gas industries – Corrosion-resistant alloy seamless tubes for use as casing, tubing and coupling stock – Technical delivery conditions.
FEM 1001 3rd Edition: Rules for the Design of Hoisting Appliances, Section 1, Booklets 3 to 8.

■ *Section 15*
Dynamic positioning systems

15.1 Recognised codes and standards for dynamic positioning systems

15.1.1 The following Standard is recognised by LR:
IMCA M 103 Guidelines for the design and operation of dynamically positioned vessels.

■ *Section 16*
Ergonomics of control stations

16.1 Recognised codes and standards for ergonomics of control stations

16.1.1 The following Codes and Standards are recognised by LR:
ISO 8468 Ships and marine technology - Ship's bridge layout and associated equipment – Requirements and guidelines.
ISO 11064 Ergonomic design of control centres.

■ *Section 17*
Fire and safety standards

17.1 Recognised codes and standards for fire and safety standards

17.1.1 The following Codes and Standards are recognised by LR:
ISO 13702 Petroleum and natural gas industries – Control and mitigation of fires and explosions on offshore production installations – Requirements and guidelines.
ISO 15370 Ships and marine technology – Low location lighting (LLL) on passenger ships – Arrangement.
ISO 15544 Petroleum and natural gas industries – Offshore production installations – Requirements and guidelines for emergency response.
ISO 17631 Ships and marine technology – Shipboard plans for fire protection, life-saving appliances and means of escape.
ISO 24409-1 Ships and marine technology – design, location and use of shipboard safety signs, safety notices and safety markings - Part 1: Design principles.
NFPA No. 1 Fire Prevention Code.
NFPA No. 10 Portable Extinguishers.
NFPA No. 11 Low-Expansion Foam.
NFPA No. 11A Medium- and High-Expansion Foam Systems.
NFPA No. 11C Mobile Foam Apparatus.
NFPA No. 12 Carbon Dioxide Systems.
NFPA No. 12A Halon 1301 Systems.
NFPA No. 13 Sprinkler Systems.
NFPA No. 15 Water Spray Fixed Systems.
NFPA No. 14 Standpipe, Hose Systems.
NFPA No. 16 Deluge Foam-Water Systems.
NFPA No. 16A Closed Head Foam-Water Sprinkler Systems.
NFPA No. 17 Dry Chem. Ext. Systems.
NFPA No. 17A Wet Chem. Ext. Systems.
NFPA No. 20 Centrifugal Fire Pumps.
NFPA No. 25 Water-based Fire Protection Systems.
NFPA 51 Standard for the Design and Installation of Oxygen - Fuel Gas Systems for Welding, Cutting, and Allied Processes.
NFPA 55 Compressed Gases and Cryogenic Fluids Code.
NFPA No. 68 Venting of Deflagrations.
NFPA No. 69 Explosion Prevention Systems.
NFPA No. 80 Fire Doors and Fire Windows.
NFPA No. 170 Fire Safety Symbols.
NFPA No. 704 Fire Hazards of Materials.
NFPA No. 750 Standard for Installation of Water Mist Fire Suppression System.
NFPA No. 2001 Clean Agent Ext. Systems.
HSE OTI 95-634 Jet Fire Resistance Test of Passive Fire Materials.

■ *Section 18*
General structural items (skids, support frames and trusses etc.)

18.1 Recognised codes and standards for general structural items (skids, support frames and trusses etc.)

18.1.1 The following Codes and Standards are recognised by LR:
AISC LRFD Manual of Steel Construction – Load and Resistance Factor Design.
AISC Manual of Steel Construction – Allowable Stress Design.
API BUL 2U Design of Flat Plate Structures.
API RP 2A – WSD Recommended Practice for Planning, Design and Constructing Fixed Offshore Platforms Working Stress Design.
API RP 2SK Recommended Practice for Design and Analysis of Stationkeeping Systems for Floating Structures.
BS 2853 The Design and Testing of Steel Overhead Runway Beams.
BS 5400Steel, Concrete and Composite Bridges – Part 9: Bridge Bearing.
BS 5950 Structural Use of Steelwork in Building.

BS 6399-2 Loads for Buildings, Code of Practice for Wind Loads.
BS 8100 Lattice Towers and Masts.
BS 8118 Structural Use of Aluminium.
BS EN 1993 Eurocode 3: Design of Steel Structures.
EN 1337 Structural bearings – Part 5: European Standard, Construction Standardisation: Pot Bearing.
EN 1337-10 Structural bearings – Part 10: Inspection and maintenance.
EN 1337-11 Structural bearings – Part 11: Transport, storage and installation.
EN 1337-1Structural bearings – Part 1: General design rules.
EN 1337-2Structural bearings – Part 2: Sliding elements.
EN 1337-3Structural bearings – Part 3: Elastomeric bearings.
EN 1337-8Structural bearings – Part 8: Guide bearings and restrain bearings.
EN 1337-9Structural bearings – Part 9: Protection.
Euro-code 3 Design of steel structures – Part 2: Steel Bridge.

■ *Section 19*
Geotechnical

19.1 Recognised codes and standards for geotechnical

19.1.1 The following Codes and Standards are recognised by LR:
API RP 2GEO Geotechnical and Foundation Design Considerations.
Geotechnical & Geophysical Investigations for Offshore and Nearshore Developments, International Society for Soil Mechanics and Geotechnical Engineering, 2005.
IMCA S 012, Guidelines on installation and maintenance of GNSS-based positioning systems, August 2009.
IMCA S 015 Guidelines for GNSS based positioning systems in the oil and gas industry, July 2011.
IMCA S 017, Guidance on vessel USBL systems for use in offshore survey and positioning operations, April 2011.
ISO 19901-2, Petroleum and natural gas industries – Specific requirements for offshore structures – Part 2: Seismic design procedures and criteria.
ISO 19901-4, Petroleum and natural gas industries – Specific requirements for offshore structures – Part 4: Geotechnical and foundation design considerations.
ISO 19901-7, Petroleum and natural gas industries – Specific requirements for offshore structures – Part 7: Station keeping systems for floating offshore structures and mobile offshore units.
ISO 19901-8, Petroleum and natural gas industries – Specific requirements for offshore structures – Part 8:Marine Soil Investigations.

■ *Section 20*
Hazardous area classification

20.1 Recognised codes and standards for hazardous area classification

20.1.1 The following Codes and Standards are recognised by LR:
API RP 500 Classification of Locations for Electrical Installations at Petroleum Facilities.
API RP 505 Classification of Locations for Electrical Installations at Petroleum Facilities, Classed as Class I, Zones 0, 1 & 2.
EN 13463 series Non-electrical equipment for use in potentially explosive atmospheres.
EN 14986 Design of fans working in potentially explosive atmospheres.
IEC 60079 series Explosive atmospheres.
IP Code, Part 3 Refining Safety Code.
IP Code, Part 8 Drilling and Production Safety Code for Offshore Operations.
IP Code, Part 15 Area Classification Code for Petroleum Installations.
ISO 17776 Petroleum and natural gas industries – Offshore production installations – Guidelines on tools and techniques for hazard identification and risk assessment.
NFPA 30 Flammable and Combustible Liquids Code.

■ *Section 21*
Helidecks

21.1 Recognised codes and standards for helidecks

21.1.1 The following Codes and Standards are recognised by LR:
CAP 437 Standards for Offshore Helicopter Landing Areas.
CAA Paper 2008/03 Helideck Design Considerations – Environmental Effects.

■ *Section 22*
Lifting appliances

22.1 Recognised codes and standards for lifting appliances

22.1.1 The following Codes and Standards are recognised by LR:
API Spec 2C Specification for Offshore Pedestal Mounted Cranes.
ASME B30.20 Below the Hook Lifting Devices.
API Spec 8C Drilling and Production Hoisting Equipment (PSL 1 and PSL 2).
EN 13586+A1 Cranes – Access.
EN 13852-1 Cranes - Offshore cranes - Part 1: General purpose offshore cranes.
EN 13852-2 Cranes - Offshore cranes - Part 2: Floating cranes.
FEM 1.001 Section-1: Heavy lifting appliances – Rules for the design of Hoisting Appliance Methods of Strength Calculation.
ISO 2374 Lifting Appliances – Range of Maximum Capacities for Basic Models.
ISO 4309 Cranes - Wire Ropes - Care and Maintenance, Inspection and Discard.
ISO 8383 Lifts on ships - Specific requirements.
ISO 8566 Cranes - Cabins and control stations.
ISO 10245 (all parts) Cranes – Limiting and indicating devices.
ISO 13534 Petroleum and natural gas industries – Drilling and production equipment – Inspection, maintenance, repair and remanufacture of hoisting equipment.
ISO 13535 Petroleum and natural gas industries – Drilling and production equipment – Hoisting equipment.
LR's Code for Lifting Appliances in a Marine Environment.

■ *Section 23*
Materials for hydrogen sulphide service

23.1 Recognised codes and standards for materials for hydrogen sulphide service

23.1.1 The following Codes and Standards are recognised by LR:
ISO 15156-1 Petroleum and natural gas industries – Materials for use in H2S- containing environments in oil and gas production – Part 1: General principles for selection of cracking-resistant materials.
ISO 15156-2 Petroleum and natural gas industries – Materials for use in H2S - containing environments in oil and gas production – Part 2: Cracking-resistant carbon and low alloy steels, and the use of cast irons.
ISO 15156-3 Petroleum and natural gas industries – Materials for use in H2S - containing environments in oil and gas production – Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys.
NACE MR0175/ISO 15156 Petroleum and Natural gas industries materials for use in H2S containing environment in oil and gas production.

■ *Section 24*
Mooring and towing fittings

24.1 Recognised codes and standards for mooring and towing fittings

24.1.1 The following Codes and Standards are recognised by LR:
ISO 13728 Ships and marine technology – Ship's mooring and towing fittings – Panama chocks.
ISO 13795 Ships and marine technology – Ship's mooring and towing fittings – Welded steel bollards for sea-going vessels.

■ *Section 25*
Mooring winches and wires

25.1 Recognised codes and standards for mooring winches and wires

25.1.1 The following Codes and Standards are recognised by LR:
ISO 3730 Ships and marine structures – Mooring winches.
ISO 2408 Steel wire ropes for general purposes – Minimum requirements.

■ *Section 26*
Offshore containers

26.1 Recognised codes and standards for offshore containers

26.1.1 The following Codes and Standards are recognised by LR:
BS EN 12079-1:Offshore containers and associated lifting sets. Design, manufacture and marking.
CAP 437 Standards for Offshore Helicopter Landing Areas.
International Maritime Dangerous Goods Code.

■ *Section 27*
Piping systems and materials

27.1 Recognised codes and standards for piping systems and materials

27.1.1 The following Codes and Standards are recognised by LR:
ANSI/ASME B31.3 Process piping.
API Bul 2J Comparison of Marine Drilling Riser Analysis.
API RP 14E Design and Installation of Offshore Production Platform Piping Systems.
API RP 16C Specification for Choke and Kill Systems.
API RP 16Q Design and Operation of Marine Drilling Riser Systems.
API RP 16R Design Rating and Testing of Marine Drilling Riser Couplings.
API RP 17B Flexible Pipe.
API RP 17B Recommended Practice for Flexible Pipe.
API RP 2RD Riser Design.
API Spec 6D Pipeline Valves (Gate, Plug, Ball and Check Valves).
API Spec 6FA Fire Test for Valves.
API Spec.17J Specification for Unbonded Flexible Pipe.
API STD 527 Seat tightness of pressure relief valves.
API STD 6AV2 Installation, Maintenance, and Repair of Surface Safety Valves and Underwater Safety Valves Offshore.
ASME B16.47 Large Diameter Steel Flanges: NPS 26 Through NPS 60.
ASME B16.5 Pipe Flanges and Flanged Fittings.
ASME B40.100 Pressure Gauges and Gauge Attachments.
BS 3351 Specification for Piping Systems for Petroleum Refineries and Petrochemical Plants.
BS PD 8010 Code of Practice for Pipelines, Part 3, Pipelines Subsea: Design, Construction and Installation.
ISO 10414 Petroleum and natural gas industries – Field testing of drilling fluids.
ISO 10426 Petroleum and natural gas industries – Cements and materials for well cementing.
ISO 10427 Petroleum and natural gas industries – Equipment for well cementing.
ISO 10434 Bolted bonnet steel gate valves for the petroleum, petrochemical and allied industries.
ISO 11960 Petroleum and natural gas industries – Steel pipes for use as casing or tubing for wells.
ISO 13623 Petroleum and natural gas industries – Pipeline transportation systems.
ISO 13703 Petroleum and natural gas industries – Design and installation of piping systems on offshore production platforms.
ISO 13847 Petroleum and natural gas industries – Pipeline transportation systems – Welding of pipelines.
ISO 14313 Petroleum and natural gas industries – Pipeline transportation systems – Pipeline valves.
ISO 1461 Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods.
ISO 14692. Petroleum and natural gas industries – Glass-reinforced Plastics (GRP) Piping.
ISO 14726 Ships and marine technology – Identification colours for the content of piping systems.
ISO 15156 Petroleum and natural gas industries – Materials for use in 2 -containing environments in oil and gas production.
ISO 15463 Petroleum and natural gas industries – Field inspection of new casing, tubing and plain-end drill pipe.
ISO 15590 Petroleum and natural gas industries – Induction bends, fittings and flanges for pipeline transportation systems.
ISO 15649 Petroleum and natural gas industries – Piping.
ISO 15761 Steel gate, globe and check valves for sizes DN 100 and smaller, for the petroleum and natural gas industries.
ISO 16070 Petroleum and natural gas industries – Downhole equipment – Lock mandrels and landing nipples.
ISO 18165 Petroleum and natural gas industries – Performance testing of cementing float equipment.
ISO 3183 Petroleum and natural gas industries – Steel pipe for pipeline transportation systems.
ISO 8434-1 Metallic tube connections for fluid power and general use – Part 1: 24 deg cone connectors.
UKOOA Specification and Recommended Practice for the Use of GRP Piping Offshore.

■ *Section 28*
Potable water and fresh water systems

28.1 Recognised codes and standards for potable water and fresh water systems

28.1.1 The following Codes and Standards are recognised by LR:
ANSI Z358.1 Emergency shower and eyewash equipment.
BS 2486 Recommendations for treatment of water for steam boilers and water heaters.
BS 6920-1 Suitability of non-metallic materials and products for use in contact with water intended for human consumption with regard to their effect on the quality of the water.
BS 7593 Code of practice for treatment of water in domestic hot water central heating systems .
BS EN 12953-10 Shell boilers. Requirements for feedwater and boiler water quality.
EN 1717 Protection against pollution of potable water installations and general requirements of devices to prevent pollution by backflow.
ISO 15748-1 Ships and marine technology – Potable water supply on ships and marine structures. Part 1: Planning and design.
ISO 15748-2 Ships and marine technology – Potable water supply on ships and marine structures. Part 2: Method of calculation.
NIPH Water Report 129 – Safe, Sufficient and Good Potable Water Offshore.
NSF/ANSI 60 - Drinking Water Treatment Chemicals – Health Effects.
NSF/ANSI 61 - Drinking Water System Components - Health Effects.
Seahealth Denmark - Drinking Water On Board Ships - A guidance about how to provide clean drinking water.
World Health Organisation - Guide to Ship Sanitation.
World Health Organisation - Guidelines for Drinking Water Quality.

■ *Section 29*
Pressure vessels/fired units/heat exchangers

29.1 Recognised codes and standards for pressure vessels / fired units / heat exchangers

29.1.1 The following Codes and Standards are recognised by LR:
API 660 Shell and tube heat exchangers for general refinery service.
API 661 Air Cooled Heat Exchangers for General Refinery Service.
API 662 Plate Heat Exchanger for General Refinery Services.
API RP 530 Calculation of Heater. Tube Thickness in Petroleum Refineries.
ASME BPVC Sec I Boiler And Pressure Vessel Code, Section I, Rules For The Construction Of Power Boilers.
ASME BPVC Sec IX Boiler And Pressure Vessel Code, Section Ix, Welding And Brazing Qualifications.
ASME BPVC Sec V Boiler And Pressure Vessel Code, Section V, Nondestructive Examination.
ASME BPVC Sec VIII-1 Boiler And Pressure Vessel Code, Section Viii, Rules For The Construction Of Pressure Vessels, Division 1.
ASME BPVC Sec VIII-2 Boiler And Pressure Vessel Code, Section Viii, Rules For The Construction Of Pressure Vessels, Division 2 – Alternative Rules.
ASME BPVC Sec VIII-3 Boiler And Pressure Vessel Code, Section Viii, Rules For The Construction Of Pressure Vessels, Division 3 – Alternative Rules For Construction Of High Pressure Vessels.
ASME Section 1 Power Boilers.
ASME Section IV Heating Boilers.
BS 2790 Shell Boiler of Welded Construction.
BS EN 12952 Water-Tube Steam Generating Plant.
EEMUA PUB No 143 Recommendations for Tube End Welding: Tubular Heat Transfer Equipment (Part 1 – Ferrous Materials).
ISO 13704 Petroleum, petrochemical and natural gas industries – Calculation of heatertube thickness in petroleum refineries.
ISO 13705 Petroleum, petrochemical and natural gas industries – Fired heaters for general refinery service.
ISO 13706 Petroleum, petrochemical and natural gas industries – Air-cooled heat exchangers.
ISO 15547 Petroleum, petrochemical and natural gas industries – Plate-type heat exchangers.
ISO 16812 Petroleum, petrochemical and natural gas industries – Shell-and-tube heat exchangers.
ISO 16812 Petroleum, petrochemical and natural gas industries – Shell-and-tube heat exchangers.
PD 5500 Unfired Fusion Welded Pressure Vessel.
TBK-1-2 General Rules for Pressure Vessels.
TEMA Standards of the Tubular Exchangers Manufacturers Association.
WRC Bull 107 Welding Research Council – Local Stresses in Spherical and Cylindrical Due to External Loading.
WRC Bull 297 Welding Research Council – Local Stresses in Spherical and Cylindrical Shells Due to External Loading on nozzles – Supplement to WRC Bull 107.

■ *Section 30*
Process plant equipment

30.1 Recognised codes and standards for process plant equipment

30.1.1 The following Codes and Standards are recognised by LR:
API 610 Centrifugal Pumps for General Refinery Service.
API 615 Sound Control of Mechanical Equipment for Refinery Service.
API 616 Combustion Gas Turbines for General Refinery Service.
API 617 Centrifugal Compressors for General Refinery Services.
API RP 550 Recommended Practice: Manual on Installation of Refinery Instruments and Control Systems, Parts 1 to 4.
API Std 613 Special Purpose Gear Units for Petroleum, Chemical, and Gas Industry Services.
API Std 614 Lubrication, Shaft-Sealing, and Control-Oil Systems and Auxiliaries for Petroleum, Chemical and Gas Industry Services.
API Std 618 Reciprocating Compressors for Petroleum, Chemical, and Gas Industry Services.
API Std 619 Rotary Type Positive Displacement Compressors for Petroleum, Chemical, and Gas Industry Services.
API Std 620 Design and Construction of large, welded, low-pressure storage tanks.
API Std 650 Welded steel tanks for oil storage.
API Std 670 Machinery Protection Systems.
API Std 671 Special purpose Couplings for Petroleum, Chemical and Gas Industry Services.
API Std 672 Packaged, integrally geared, centrifugal air compressors for petroleum, chemical and gas industry services.
API Std 673 Centrifugal Fans for Petroleum, Chemical and Gas Industry Service.
API Std 674 Positive displacement pumps – Reciprocating.
API Std 675 Positive displacement pumps – Controlled volume.
API Std 676 Positive displacement pumps – Rotary.
API Std 681 Liquid Ring Vacuum Pumps and Compressors for Petroleum, Chemical, and Gas Industry Services.
API Std 682 Shaft Sealing Systems for Centrifugal and Rotary Pumps.
ASME B73.1 Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process.
ASME B73.2M Specification for Vertical In-Line Centrifugal Pumps for Chemical Process.
EEMUA PUB No 141 Guide to the use of Noise Procedure Specification.
ISO 10431 Petroleum and Natural Gas Industries – Pumping Units – Specification.
ISO 10436 Petroleum and Natural Gas Industries – General purpose steam turbines for refinery service.
ISO 10437 Petroleum, petrochemical and natural gas industries – Steam turbines – Special-purpose applications.
ISO 10438 Petroleum, petrochemical and natural gas industries – Lubrication, shaft-sealing and control-oil systems and auxiliaries.
ISO 10439 Petroleum, chemical and gas service industries – Centrifugal compressors.
ISO 10440 (all parts) Petroleum and Natural Gas Industries – Positive displacement-rotary type compressors.
ISO 10441 Petroleum, petrochemical and natural gas industries – Flexible couplings for mechanical power transmission –Special-purpose applications.
ISO 13631 Petroleum and natural gas industries – Packaged reciprocating gas compressors.
ISO 13691 Petroleum and natural gas industries – High-speed special-purpose gear units.
ISO 13707 Petroleum and natural gas industries – Reciprocating compressors.
ISO 14310 Petroleum and natural gas industries – Downhole equipment – Packers and bridge plugs.
ISO 14691 Petroleum and natural gas industries – Flexible couplings for mechanical power transmission – General purpose applications.
ISO 15136 Downhole equipment for petroleum and natural gas industries – Progressing cavity pump systems for artificial lift.
ISO 2314 Gas Turbine Acceptance Tests.
ISO 2858 End-suction centrifugal pumps (rating 16 bar) – Designation, nominal duty point and dimensions.
ISO 2954 Mechanical vibration of rotating and reciprocating machinery – Requirements for instruments for measuring vibration severity.
ISO 3046 (all parts) Reciprocating internal combustion engines – Performance.
ISO 3977 (all parts) Gas turbines – Procurement. ISO 5199 Technical specs. for centrifugal pumps- Class II.
ISO 9906 Roto-dynamic pumps – Hydraulic performance acceptance tests – Grades 1 and 2.
NFPA No. 37 Stationary Combustion Engines and Gas Turbines.

■ *Section 31*
Process safety

31.1 Recognised codes and standards for process safety

31.1.1 The following Codes and Standards are recognised by LR:
API STD 520 Sizing, Selection, and Installation of Pressure-relieving Devices Part I & Part II.
API STD 521 Pressure Relieving and Depressurising Systems.
API STD 537 Flare Details for General Refinery and Petrochemical Service.
API STD 2000 Venting Atmospheric and Low-Pressure Storage Tanks.
API RP 14C Recommended Practices for Analysis, Design, Installation and Testing of Basic Surface Safety Systems on Offshore Production Platforms.
API RP 14J Recommended Practice for Design and Hazards Analysis for Offshore Production Facilities.
API RP 17O Recommended Practice for Subsea High Integrity Pressure Protection Systems (HIPPS).
ISO 10418 Petroleum and natural gas industries - Offshore production installations - Basic surface process safety systems.
ISO 23251 Petroleum, petrochemical and natural gas industries - Pressure-relieving and depressuring systems.
ISO 25457 Petroleum, petrochemical and natural gas industries - Flare details for general refinery and petrochemical services.
ISO 28300 Petroleum, petrochemical and natural gas industries - Venting of atmospheric and low pressure storage tanks.

■ *Section 32*
Reliability-centred maintenance

32.1 Recognised codes and standards for reliability centred maintenance

32.1.1 The following Codes and Standards are recognised by LR:
NACE MR0175/ISO 15156 Petroleum and Natural gas industries materials for use in 2 H2S-containing environment in oil and gas production.
ISO 19901-4 Petroleum and natural gas industries – Specific requirements for offshore structures – Part 4: Geotechnical and foundation design considerations.
ISO 15156-1 Petroleum and natural gas industries – Materials for use in 2 -containing environments in oil and gas production – Part 1: General principles for selection of cracking-resistant materials.
ISO 15156-2 Petroleum and natural gas industries – Materials for use in 2 -containing environments in oil and gas production – Part 2: Cracking-resistant carbon and low alloy steels, and the use of cast irons.
ISO 15156-3 Petroleum and natural gas industries – Materials for use in 2 -containing environments in oil and gas production – Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys.
ISO 14224 Petroleum, petrochemical and natural gas industries – Collection and exchange of reliability and maintenance data for equipment.

■ *Section 33*
Safety of machinery

33.1 Recognised codes and standards for safety of machinery

33.1.1 The following Codes and Standards are recognised by LR:
ISO 12100 *Safety of machinery - General principles for design - Risk assessment and risk reduction.*
ISO 13850 *Safety of machinery - Emergency stop - Principles for design.*
ISO 14122 *series - Safety of Machinery - Permanent Means of Access to Machinery.*
ISO 21789 Gas turbine applications – Safety.

■ *Section 34*
Subsea

34.1 Recognised codes and standards for subsea

34.1.1 The following Codes and Standards are recognised by LR:
ISO 14723 Petroleum and natural gas industries – Pipeline transportation systems – Subsea pipeline valves.
ISO 13628-1 Petroleum and natural gas industries – Design and operation of subsea production systems – Part 1: General requirements and recommendations.
ISO 13628-2 Petroleum and natural gas industries – Design and operation of subsea production systems – Part 2: Unbonded flexible pipe systems for subsea and marine applications.
ISO 13628-3 Petroleum and natural gas industries – Design and operation of subsea production systems – Part 3: Through flowline (TFL) systems.

ISO 13628-4 Petroleum and natural gas industries – Design and operation of subsea production systems – Part 4: Subsea wellhead and tree equipment.
ISO 13628-5 Petroleum and natural gas industries – Design and operation of subsea production systems – Part 5: Subsea umbilicals.
ISO 13628-6 Petroleum and natural gas industries – Design and operation of subsea production systems – Part 6: Subsea production control systems.
ISO 13628-9 Petroleum and natural gas industries – Design and operation of subsea production systems – Part 9: Remotely Operated Tool (ROT) intervention systems.

■ *Section 35*
Ventilation

35.1 Recognised codes and standards for ventilation

35.1.1 The following Codes and Standards are recognised by LR:
ASHRAE HVAC Applications.
ASHRAE HVAC Systems and Equipment.
ASHRAE/ANSI STD 62 Ventilation for Acceptable Indoor Air Quality.
ISO 15138 Petroleum and natural gas industries - offshore production installations - heating, ventilation and air-conditioning.
ISO 7547 Ships and marine technology – Air conditioning and ventilation of accommodation spaces - Design conditions and basis of calculation.
ISO 8861 Ships and marine technology – Engine room ventilation in diesel engine ships – Design conditions and basis of calculation.
ISO 9943 Shipbuilding – Ventilation and air-treatment of galleys and pantries with cooking appliances.
NFPA 90A Standard for the Installation of Air-Conditioning and Ventilation Systems.
NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
Note production units only:
SMACNA HVAC Duct Construction Standards.
SMACNA HVAC Systems Duct Design.

■ *Section 36*
Wave contour development

36.1 Recognised codes and standards for wave contour development

36.1.1 The following Standard is recognised by LR:
Environmental Parameters for Extreme Response: Inverse Form with Omission Factors, Winterstein et al, ISBN No. 9054103571.

■ *Section 37*
Wellhead equipment

37.1 Recognised codes and standards for wellhead equipment

37.1.1 The following Codes and Standards are recognised by LR:
API Spec. 6A & ISO 10423 Wellhead and Christmas Tree: Equipment.
API Spec. 14D Wellhead Surface Safety Valves and Underwater Safety Valves for Offshore Service.
API RP 14B Design, Installation and Operation of Subsurface Safety Valve Systems.
API RP 17D Specification for Subsea Wellhead and Christmas Tree Equipment.

■ *Section 38*
Wind gust spectra formulations

38.1 Recognised codes and standards for wind gust spectra formulations

38.1.1 The following Standards recognised by LR:
API RP 2A Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms.
Deaves D.M & Harris R.I 1978 A mathematical model of the structure of strong winds, CIRIA Report No. 76.
Slettringen (Norwegian Petroleum Directorate).

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